The Builder.

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The Craft of the Carpenter.

CARPENTRY may be briefly defined as the art of framing timbers for various purposes of support; but much more is implied in this definition than is apparent on the face of it, for just as the strength of a chain is only that of its weakest link, so however carefully an assemblage of pieces of timber may be framed together, if they are so arranged that the weakest point of the framing is where the strain on it is greatest, no mere skill in adjusting the parts will prevent failure. Hence it is necessary, as Professor Robison remarked, that a skilled carpenter should know the mathematical and mechanical laws according to which strains are propagated on the one hand, and the material fibres of timber are exerted in resistance to them on the other. For the designer who is, or ought to be, the architect, something more is required, and that is a knowledge of the geometrical rules according to which graphic delineations of various forms are drawn,—in other words, of stereotomy. We are afraid that these very essential branches of an architect's education have been too much neglected, and, in fact, almost ignored in this country. In France and Germany much greater importance is attached to these subjects, and various papers have been read recently at the architectural societies' meetings, which we hope will have the effect of drawing attention to the methods of education adopted in those countries. Old Nicholson, who is always interesting and instructive, though not always accurate, says that "no man may pretend to be an architect who is not well acquainted with the principles and practice of carpentry"; and Tredgold, writing in 1820, laments the fact that "in consequence of the neglect by architects of the principles of construction, works requiring any considerable skill are given to the members of a new profession,—civil engineers."

Although carpentry must necessarily have been one of the first arts practised by man in an early state of civilisation, it would advance but slowly in consequence of the slender resources of the early builders, and the probability is that timbers would at first be joined by ligatures and not by mortises and tenons; but the use of iron for cutting-tools was very early, and we know, from Wilkinson's researches, that the Egyptians were very expert carpenters and used a most complicated system of dove-tailing. The buildings of the Romans show them to have been great carpenters, and their mantle, probably, descended on such men as Serlio and Palladio, whose works are the earliest treating of the subject at all fully. We get an occasional glimpse from old travellers' records of skill in carpentry in most unexpected places; for example, Pyrard de la Val, a Frenchman who was wrecked on the Maldive Islands in 1601 and wrote an account of his voyage, states that the carpentry and joinery there was of the finest and most beautiful kind, no iron being used. Mediæval carpentry depended upon large and heavy scantlings, but was always good, simple, and well proportioned. It attained its highest development in the sixteenth century, and depended almost entirely on skilful framing without iron straps. Viollet-le-Duc says of it: "Le fer ne vient pas, comme dans les charpentes modernes, suppléer à l'insuffisance ou à la faiblesse des assemblages." There can be no doubt that the extended use of iron has led to the decadence of carpentry proper, and, if we want to find the technical skill of the old carpenters, we shall have to look for it in some of the more secluded English villages.

We have still no work in English equal in completeness to Colonel Emy's "Traité de l'Art de la Charpenterie," published in Paris in 1841, and in fact there have been very few English works on carpentry of any importance, the earliest that we are acquainted with being Richards's translation of the first book of Palladio, published in 1676, the phraseology of which is very quaint and instructive, because all the old terms of carpentry such as *summer*, *interduce*, *wind-beam*, and others, show the original purpose of many parts of a building which have quite lost their former meaning. The ablest treatises on carpentry up to a recent date are buried away in obscure places; for instance, Nicholson's article on "Carpentry" is in Rees's "Cyclopædia," and Professor Robison's article, which really forms the basis of all that has since been written, is in the "Encyc. Brit.," edit. 4. The first edition of Tredgold was published in 1820, and it has been the standard work ever since, and the sixth edition is now before us.*

The earlier editions of this work are so well known that we do not propose to allude particularly to the original matter, but we are chiefly interested in the additions. In the earlier editions of the work no attempt was made to give the mathematical investigation of the various formulæ for strength, stiffness, &c.; but reference was made to other works where this information could be obtained. We think, however, it is a great gain to the student to have these investigations, where the higher mathematics are not involved, ready to his hand, with an explanation of the method of practically applying them; and we hold, therefore, that the present editor has acted wisely in embodying these in the new edition. The mathematical investigations of the formulæ for calculating the strains upon timber in different positions, and framed in various ways, do not, with few exceptions, involve the higher mathematics, and a splendid opportunity was open to the editor, by a careful revision of the old work and the addition of new matter, to make the new edition the standard work on carpentry in the English language. In a work of this kind special care is requisite to avoid errors, and the closest possible scrutiny of the proofs is needful in order to detect mistakes, which may prove most perplexing and misleading to the student, and we are very sorry to have to notice many signs of haste or carelessness in this respect. We are not disposed to criticise too severely such slips as *verticle* line, and the statement that "timber is wrought into various forms according to the *principal* of geometry," though we think with a little care they might have been avoided.

We notice in the discussion of the question of the best form for lock-gates that the radius of the curve of equilibrium is given as $\frac{x^2 \times y^2}{2x}$, where x represents the sally of the gate, and y the half breadth of the lock: this ought to be $\frac{x^2+y^2}{2x}$, and we cannot help thinking that a diagram showing the curve of equilibrium should have been added, as in the diagram given the above expression will not hold good.

The strain upon beams when laid in a horizontal position, and loaded, is one of the most important subjects of investigation in practical carpentry, and a considerable amount of attention is paid to it in the new edition, but as the principle of the lever is so intimately connected with the subject, we should have been glad if Mr. Tarn had devoted a few paragraphs to a clearer explanation of its action, as this would have rendered many of the subsequent paragraphs easier to the student. We also think it would have been desirable to give a diagram, with a few words of explanation, showing how to calculate the moment of rupture at any point in a beam loaded by a weight placed at any other point. This is of considerable practical importance when considering the strains on girders supporting binding joists.

The strains upon beams are, on the whole, well treated, but here, again, we are quite sure,—judging from what Mr. Tarn has done in previous works,—that a little more care would

* Elementary Principles of Carpentry. By Thomas Tredgold, C.E. Sixth edition, thoroughly revised and considerably enlarged by E. Wyndham Tarn, M.A., architect. London: Crosby Lockwood & Co.

have rendered the investigations more lucid. For instance, on p. 39 the diagram is carelessly drawn, and a very slight alteration would have rendered the steps of the reasoning much clearer. Again, throughout these investigations L is supposed to represent the length in feet, l the length in inches, so that 12 L=l, yet on p. 47 in ascertaining the deflection of a beam uniformly loaded L and l are used indiscriminately to represent the same thing. This may seem a very small point, but we are strongly of opinion that these errors ought not to occur in a work of this importance.

Several examples involving the use of the integral calculus are given. Now, we think Mr. Tarn might have drawn the line at the calculus, as very few would be able to follow him; but if he does use it, at least he should be correct. But there is an equation worked out on p. 50, of which the first integration is correct, but the second is wrong, as it is based on an assumption inconsistent with one made in the first integration; and it is the more curious that this error should not have been noticed, as the result as printed is a fraction in terms of l and x, which can only equal zero when $l=x$, whereas the proper solution is something quite different. Now, it is scarcely kind of the editor thus to befog the student who attempts to follow him. It may be said that if the results are given correctly these errors are not of very material consequence, but we assume the editor would not have given the steps of the calculations unless he thought they would be useful to some one. It is, however, when we come to the tables of scantlings that we find ourselves most hopelessly perplexed. In the earlier editions of this work it was stated that the table of scantlings for girders in a framed floor was calculated from experimental data, and there is no doubt that the scantlings there given were inadequate for the longer bearings. There is a considerable amount of new matter in this section, and the strains are estimated upon girders in accordance with the number of points at which the weight rests on the girder: 120 lb. per foot super. is taken as the load of the floor, the girders being supposed to be 10 ft. apart. Now, let W represent the entire weight of that portion of the floor extending 5 ft. on each side of the centre of the girder; then, if the latter be about 12 ft. long, it will have but one binding-joist resting on it, and the load on the girder will be $\frac{W}{2}$ at the centre. The longer the girder the greater will be the number of binders resting on it, and the more nearly will the load on the girder approach to W, but also the more nearly will it be a distributed load, which would be equivalent to $\frac{W}{2}$ at the centre, so that the strain on the girder varies very slightly whatever the number of the binders may be. The mathematical investigation is, however, interesting from the fact that it shows clearly that how many soever the binders may be the strain is always a maximum when one of them rests on the centre of the girder, and this shows the great desirability of leaving the centre of any timber beam free from load whenever possible. When the weight is taken at 120 lb. per foot super., the familiar formula $B D^3 = a W L^2$ becomes $B D^3 = 6 L^3$, or very near it, and from this formula the scantlings in the new table are professedly calculated. This table interested us considerably, as it differs from Tredgold's *toto cælo*; but we are very sorry to say it is not reliable for the longer bearings when tested by Mr. Tarn's own formulæ. For instance, a girder 30 ft. long and 18 in. deep is given 21 in. wide; in reality, according to the formula, it should be 27 in. wide, and it is actually stated that the dimensions of a timber girder 36 ft. long may be 17 in. deep and 37 in. wide. A girder of this depth and bearing ought to be, according to the formula, 57 in. wide. We do not wonder that Mr. Tarn recoiled from this dimension. But even the scantling given in the tables is rather startling, and such a girder would be somewhat of a curiosity. We have calculated the deflection of such a girder when loaded, and we find it would be $1\frac{7}{8}$ in. instead of $\frac{9}{10}$ in. as it ought to be. Now what is the practical use of giving tables of this kind? No one nowadays would think of using timber for such bearings as this, and if Mr. Tarn had said that iron was always used now for long bearings, but that if on an emergency timber had to be used for a 36 ft. bearing, it should be a built-up beam, 26 in. deep and $15\frac{1}{2}$ in. broad, this would have been a piece of useful information, and would also have had the merit of being correct, and the same plan might have been adopted with all girders over 24 ft. bearing. The method of building up beams by bolting and keying two pieces together is described on pp. 90 and 91; but here, again, we must complain of the carelessness of the revision of the work, as we find in the letterpress references to figs. 42, 43, 44, and 45 on Plate IV., but when we turn to Plate IV. we find no figures at all thus numbered, the illustrations referred to being numbered 5, 6, 7, and 8; and this is by no means the only instance where illustrations are wrongly indicated,—the reader has to hunt them out on the plates for himself. The tables for binding joists and for single joists also differ from Tredgold's, and here, again, we find they are not accurately calculated according to Mr. Tarn's own formula; for instance, a single joist 20 ft. long and 3 in. wide is given as $11\frac{1}{4}$ in. deep, whereas the rule makes it $12\frac{1}{2}$ in. deep; and, in the same way, a joist of similar bearing of 2 in. breadth is given as 13 in. deep, when it should be over 14 in.; and we are disposed to ask whether 19 in. by $1\frac{1}{2}$ in. is a practical dimension for a joist of 25 ft. bearing. Moreover, according to this table, a joist 8 in. by $3\frac{1}{2}$ in. is of the same stiffness as one 8 in. by 4 in., and several similar cases could be pointed out. We find it to be the same with the table for binding-joists; for instance, a binder 20 ft. long and 12 in. deep is given as 17 in. wide: if tested by the rule it ought to be $20\frac{1}{2}$ in. wide. The table gives the breadth of a binder 14 in. deep for a 17 ft. bearing as 7 in., the rule makes it over 8 in.

Now, for one person who will read the work throughout probably a hundred will consult the tables, and the least the editor could have done, after deciding to alter tables which have been accepted for so many years, would have been to take care that the calculations are accurate and the dimensions practical. We are not saying that timbers of the scantlings given would break when loaded in the ordinary way, but these tables are professedly calculated for *stiffness* and not for *strength*, and the necessity of distinguishing between these two properties is frequently alluded to, as the comparative stiffness of timbers is of much more importance than the comparative strength; a girder, for instance, carrying both floor joists and ceiling joists would deflect enough to utterly ruin a ceiling, while there would be no danger of its breaking.

When we come to the section on roofs, we find that the useful remarks of Tredgold on roofs, domes, &c., are reproduced, together with new matter, which, in some cases, is very valuable; but we are continually being pulled up by annoying errors which a little care would have avoided. Here, again, the tables of scantlings are altered, new rules for calculating them are given, but in many instances the figures given are not those obtained by the rule.

We will take two instances: first, that of a tie-beam. Tredgold's old rule is, "Take the length of the longest unsupported part in feet and divide it by the cube root of the breadth in inches, *multiply the quotient by* 1·47, *and the result will be the depth*," and on this calculation his tables are based, and we have always found them reliable. Mr. Tarn gives the rule as above, with the omission of the words in italics, but he does *not* act upon his rule. Take the case of a roof 50 ft. span of the design shown on Plate IX, the longest unsupported part of this tie-beam would certainly not exceed 15 ft. Taking L to represent this length, and B and D the breadth and depth of the beam, the rule says $D = \frac{L}{\sqrt[3]{B}}$, which when $B=6=\frac{15}{\sqrt[3]{6}}$, or just over 8 in. for the depth; but the table gives 10 in. as the depth of this tie-beam, and we should be glad if this discrepancy had been accounted for. The old table give 12 in. as the depth, and we must say we should prefer to use this. Secondly, the principal rafter. The new rule is very simple, and says:—"For a queen-post roof, multiply the cube of the span by ·0125, and the square root of the product will give the area of the principal in inches. If this be worked out for a span of 46 ft., the area of the principal would be 34·8 in. The area as given in the tables is 41·25 in. We have dwelt upon this matter of the tables at some length, because we do think it a most important matter that these should be accurate. Mr. Tarn appears to us to be in this dilemma: he has altered the old tables and gives new rules for calculating them; either these rules are reliable or they are not; if not, why are they given? if they are reliable, why does he not act upon them? No one can retain in his memory a number of tables, whereas simple rules can be learned by heart and applied when wanted; but it scarcely inspires confidence in these rules to find their author departing from them so frequently without a word of explanation.

The latter part of the work comprises a great deal of very useful and interesting information on the nature and properties of timber, in which advantage has been taken of the investigations made on this branch of the subject subsequently to Tredgold's time by Rhind, Laslett, and Fincham; but we must most strongly protest against the manner in which the references to the works consulted are given. In this section of the work there are no less than between seventy and eighty references to other works, and *in no single instance* is the page of the work referred to given. The utility of giving such a reference, for instance, as Beckman's "History of Inventions," vol. ii., is practically *nil*, as no one can spare the time to hunt through the volume to find out the exact passage. And these omissions are the less excusable as in the earlier editions the pages of the references are all given, and any new ones introduced could have been verified by a couple of hours' work.

It is in no captious spirit of fault-finding that we have noticed this work. We took it up with great expectations, and we finished its perusal with feelings of deep disappointment. We hold that the editor of such a standard work as this takes upon himself great responsibilities, and ought to exercise special care to send the work out as free from errors as the closest scrutiny can render it, and we can only hope that the present edition is not a large one, and that care will be taken to revise the revision before another edition is issued.

THE ROMAN BRIDGE OVER THE TRENT AT SOUTH COLLINGHAM.

BY E. P. LOFTUS BROCK, F.S.A.

THE discovery of ancient Roman remains is always a matter of interest, even when the objects found are only sufficient to gratify ordinary curiosity, or when they are but similar to those ordinarily met with. When the discovery reveals some object out of the common we feel that a fresh page, so to speak, of the history of bygone times is being turned over for our inspection; and feelings of curiosity give place to the more real work of practical study.

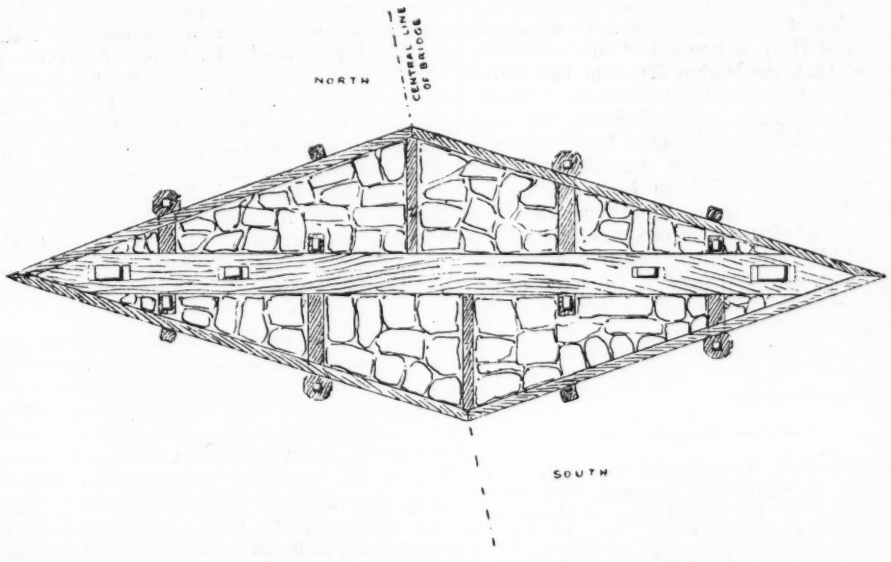
Such an event has recently occurred at South Collingham, Nottinghamshire, where sufficient of the fabric of a large Roman bridge has been found to enable us to reconstruct the structure theoretically, so completely has the design been recovered.

During recent months works have been undertaken along the course of the river Trent to improve its navigable powers, the importance of which will be rightly estimated when it is remembered that the navigation along this river connects Hull, Grimsby, and Goole with the whole Midland canal system, including Birmingham and all its district. These works are in progress by the Trent Navigation Company, under the direction of

Mr. H. Rope, C.E., engineer-in-chief to the company, and consist of, among others, of a large amount of dredging to deepen the bed of the river.

When the works had reached to a point between the villages of Cromwell on the north bank of the river and South Collingham on its southern, the workmen found a mass of timber framing and stonework in the bed of the river, resting on the undisturbed gravel formation. On examination, it was found that this unexpected obstruction was, in fact, the massive pier of a bridge. About 20 ft. nearer to the northern bank a second pier was found, precisely similar. Subsequent observation enabled the system of construction to be entirely recovered, and the details are so curious as to merit exact description. The piers were constructed of masonry, tied together by a framework of solid oak timbering, resting upon a carefully-framed base acutely diamond-shaped on plan. This latter was naturally set sill carried four piles to support the superstructure, which were driven about 3 ft. into the gravel through the sill, by means of neatly worked rectangular holes cut through it for the purpose. These piles were set slightly diagonally, being inclined at an angle from each end respectively to afford a wider base, and thus giving a lesser width for the roadway above. The angle of the supports was clearly shown by the marks in the sills, and a portion of one of them was in position. The oak was still solid and hard, and the whole bore evidence of having been skilfully framed and put together in a very workmanlike way.

Masses of masonry found in the stream during the dredging operations, as well as by the weather-worn surfaces on some of them, indicated that the piles were encased in piers of stonework, the mortar-beds and jointings still remaining on some of the stones, while rebates, as if to fit over the timbers, were also visible, some of the stones being 2 ft. high.



with its pointed ends to the stream. The extreme length from west to east was 30 ft. 9 in., the width being 10 ft., while the waterway was 20 ft. in the clear from pier to pier. The diamond shape was not an exact figure, for the bridge having crossed the river diagonally, the shape of the piers was set out to afford the proper course to the superstructure. A solid central sleeper, about 18 in. by 18 in., formed the backbone, so to speak, of the framing, the diamond forms being made up by waleing pieces about 18 in. by 4 in., carried to the extreme points and neatly mitred. These were secured into the sill by stout ties mortised through both waleing and sill in each case, ending outside the latter in large octagonal headings worked out of the solid. Square holes were sunk through these heads, and also through the opposite ends of the ties after having passed through the sills, for the insertion of stout wedges, whereby the whole of the framed structure was kept in place and rigid. Extra solidity was given to the varying position of the lateral angles marking the outline of the diamond form by struts, also laid horizontally to the main sill, and four tapering piles, two on each side, driven into the solid river bed, kept the whole in position.

This system of framing was found to be the same, or nearly so, in both of the piers met with, and it was solid and firm after the lapse of so many centuries. Indeed, when it was found necessary to remove the piers as obstructions to the deepened river bed, it was deemed advisable to use dynamite for the purpose. Eight charges of dynamite were requisite before the solid mass could be removed, and the fragments of framing recovered were still so well tied together that it was not a difficult task on shore to place them again in position, when a very interesting photograph was taken. It was evident, on observation, that the framework had been put together on the land, and simply lowered down into position afterwards, and then the spaces of the framing filled in with rubble masonry, solidly bedded in the well-known hard setting mortar, which the Romans so well knew how to make. The main The stone is similar to Ancaster, and the mass of it still remaining, built up into the walls of the oldest of the cottages and barns in the locality, on both sides of the river, is sufficient to show to how great an extent the material of the old piers was utilised at a period, it may be, long subsequently to the destruction of the bridge. No arch stones having been found, it is reasonable to conclude that the roadway was carried on a horizontal framing of oak resting on the masonry and oak piers. The width of the roadway, as determined by the rake of the piles, must have been about 20 ft. or 22 ft. It is not likely to have exceeded the latter width. The width of the Trent at the point of crossing is about 240 ft., and, making allowance for the two abutments at the river banks, seven piers would have been necessary to form the bridge. Only two have been met with and destroyed; a third one was not found, and it is probable that it was removed on some former occasion, and, since the river has receded from the southern bank (to encroach upon the old line of the northern) it is a matter almost of certainty that the traces of the remaining piers are still safe, to be revealed, it may be, to some future generation. No traces of the abutments are visible, and, indeed, nothing is very apparent of the course of the road itself, which crossed the river by this bridge. The diagonal position of the piers gives us exactly the direction of the roadway, and it may be here remarked, as evidence of the direct course taken in Roman constructions, that an obstacle such as the River Trent was not considered sufficient to cause the direct line to be diverted even to the small extent necessary to cross the river at right angles to its course.

Considerable interest has been taken in this remarkable discovery, not only by Mr. Rope, but by others, and a very careful set of plans indicating the construction has been prepared by Mr. J. H. Whieldon, Surveyor to the Company, while both these gentlemen have obligingly rendered me particulars on every point, and shown me copies of the drawings which were exhibited publicly at a recent meeting of the British Archæological Association. But for the painstaking care and attention of the engineers named, the discovery would, perhaps, have passed unnoticed, and certainly it would not have been possible for the system of construction of this important work to have been recovered.

The capabilities of oak for preservation under water during so lengthened a period, demonstrated by this discovery, as well as some others, help us to estimate the age of some similar discoveries which were passed by at the time, somewhat unnoticed. Thus the removal of old Rochester Bridge, and the construction of the present one, revealed the existence of a mass of wooden piling which we may very reasonably conclude to have been of Roman date, and a part of an ancient wooden bridge to carry the Watling-street across the Medway. In like manner, the removal of old London Bridge revealed similar evidences, while much of the Thames River bank along Billingsgate was piled at some remote period, doubtless to render the waterway secure. Close to Lanercost Priory, in Cumberland, the oak-framed base of a small Roman bridge can still be seen partly lying in the bed of the little river, the Irthing, partly raised above the water-line, it having been disturbed by some flood. It is framed in a very similar manner to what has now been described, and one work will serve to illustrate the other. The mode of construction of the upper part of the bridge spoken of, namely, a series of piers supporting horizontal bearers to carry the superstructure, had its counterpart in the fine Roman work, the North Tyne Bridge, erected on the line of the Picts' wall, to carry it across that river, where it seems to be a matter of certainty that the massive abutments, one of which is now entirely excavated for observation, were not to receive the thrust of masonry arches, but only to take, it may be, massive lintels of oak, upon which the wall across the river was built.

It is just possible that at Collingham the timber framing was erected first and the masonry filling in subsequently. Be this as may, we may reasonably conclude that some system was adopted by which air could have circulated around the timbers to prevent their decay, for such good constructors as the Romans would hardly have carried them up solidly in the mass of masonry. Examples have been met with elsewhere showing the care taken by these old builders to prevent the decay of their timber constructions, when they were even less exposed than here to the danger of being covered up. Notably, the process of charring has been met with, although not observable here. Mediæval builders were not so careful in this respect, and it not unfrequently happens that when an old wall has been examined, where bond timbering or anything of an analogous nature has been used and the air excluded, nothing has been found except the void space occupied by the wood. A noteworthy instance of this occurs at Plympton Earls. The Norman walls of the shell keep were constructed with a chain bond of timber of fairly large scantling. It has completely decayed, leaving only a curious passage in the mass of masonry, to which many and various uses have been assigned. The modern west front of St. David's Cathedral, erected by Nash at the close of the last century, had two flying buttresses springing from detached piers. These have recently been removed for the rebuilding of the front in better taste. They were found to contain wooden shores evidently erected as a support to the original front prior to its rebuilding, and retained within the mass of the masonry. Although so few years, comparatively, had elapsed, the woodwork was found to be badly decayed. Many other examples derived from old buildings might be cited, but these may suffice to show the bad results of excluding the air from any timber work. Our modern works, however, themselves teach the same lesson.

The framing at Collingham was wedged together, and neither pinned with oak nor bolted with iron,—at least, so far as the foundations were concerned; there was not sufficient evidence remaining to indicate the construc-

tion of the upper portions. The expansion of the timbers under the action of the water had made the framing very rigid and solid.

The peculiarity of the roadway not having crossed the river at right angles has already been referred to. It can scarcely be doubted but that this was arranged for to preserve exactly the straight course of the roadway, however unnecessary for practical purposes the arrangement may have been. Taking the line formed by the axis of the bridge, which is an angle of 79 degrees to the river's south bank, we find that if prolonged to the south-east it falls in with the straight course of a modern road for two miles or so, indicating most probably that this latter is on the site of the old one. If prolonged further, it would join the main Roman road, the foss-way, at a distance of about six miles and a quarter from the bridge. The foss-way was undoubtedly the principal road in this part of Nottinghamshire, and it is but reasonable to conclude that the adjacent roads must have had some relation to it. Following its course, the distance from Lincoln to the bridge would be fifteen modern miles. Taking up the line of the roadway on the other side of the river, we find that, if extended to the north-west, still going perfectly straight, it would fall in with the Roman road, Spring-lane going westward across Sherwood Forest, on the high ground, into Derbyshire, while the point of junction would be very close to the ancient encampment marked on the maps as existing just to the north-west of Kirklington. This line is but a theoretical one, based on the angle given by the bridge itself; but whatever its direction may have been, it is evident that the object of the bridge was to afford a way from Lincoln along Spring-lane. The fact that a portion of this was along the foss-way indicates that the latter road was the older of the two.

This course avoids Southwell entirely, where it is more than probable that a Roman station existed. This station would probably be reached by a road branching out of the foss-way over a bridge crossing the Trent near Winthrop, where some foundations were discovered about ninety years ago. It would then most probably be continued to the north-west to join the course of the road already referred to at Kirklington. It is also very probable that a third road started from the foss-way at East Bridgeford, going northwards up to Spring-lane.

This most remarkable discovery has naturally caused a great deal of local comment and attention, especially with respect to any evidence it may afford as to the undecided positions of the stations named in the Itineraries. These are Margidunum, Ad Pontem, and Crococalana, the latter being twelve Roman miles from Lindum (Lincoln), the others being stated as being seven miles apart from each other. The finding of the bridge not unreasonably points to Ad Pontem being somewhere in its locality, although it would apply equally well to the position of the bridge near Winthrop or to East Bridgeford. It must, however, be borne in mind that the name of this missing station does not occur in the Itinerary of Antoninus, but in the forged history, said to be the work of Richard of Cirencester, who, tracing the well-known course of the foss-way, probably found in the name East Bridgeford, where there was a Roman station, a plausible opportunity for its interpolation. The bridge at Winthrop had not been found in the days of the arch impostor referred to. The two other stations named were doubtless along the course of the foss-way, and therefore, wherever their true positions may have been, the discovery at Collingham does not afford additional evidence of their position, except, perhaps, to call attention to the point where the axis of the bridge would cut the foss-way.

It is a matter of congratulation that this discovery has been in such good hands, and that such careful attention should have been bestowed upon the details of the discovery. Still more will thanks be due to Mr. Rope, since he has the intention of having the exact position of the bridge marked for all time by a stone set in the bank of the river.

NOTES.

THE meeting at the Mansion House last week in furtherance of the better support of the Parkes Museum was at least a success in regard to the reception of the speakers who moved and supported the principal resolutions. The Duke of Cambridge moved that the Parkes Museum is meeting a great educational want, and is worthy of increased public support. Mr. Erichsen seconded the resolution, and Mr. G. Godwin, speaking in support of it, rightly urged that the premises in which the Museum was now situated were too small for the work which the institution might accomplish, and that more room was wanted for extending the instruction which could then be given to those qualifying themselves for sanitary inspectors, and for builders, plumbers, and others connected with the building trades. Lord Mount-Temple moved that it is essential to the permanent efficiency of the Parkes Museum that the number of annual subscribers be increased. Mr. Ernest Hart, in support of this resolution, observed that the Parkes Museum had served as the model for similar institutions at Washington, Paris, Turin, and Yokohama, but these museums had been subsidised by the Governments of their respective countries, while no such recognition had been bestowed on the Parkes Museum. It is surely time that this example of other Governments should be followed by our own. Some considerable donations were announced at the close of the meeting,—sufficient to meet pressing requirements, but far from what is needed to put the museum on the footing which its importance and value demand. The resolutions were passed unanimously.

THE Swedish Government are making an effort to provide a museum building at Stockholm, to be called the "Nordiska" Museum (Museum of the North), for a collection of which the nucleus will be formed by the valuable assortment of Scandinavian antiquities brought together by the energy, and at the cost, of Dr. Arthur Hazelius, and at present distributed in various rooms in Stockholm. In 1880, Dr. Hazelius, who had already designed to hand over his museum to the country as a permanent national possession, formed a committee of trustees, consisting of five persons, to co-operate with himself in carrying out his scheme, and to share with him the heavy burden of management. King Oscar, who is president of the committee, having given a suitable site in the Djurgarden, a noble park in the eastern suburbs of the city, an open competition of designs for a great museum was invited in 1883, and was mentioned in our columns. Plans were sent in last year by fifteen architects of different nationalities, to seven of which prizes were awarded, but a final decision has not yet been made. It is determined, however, that the building must be of ample dimensions to meet the requirements of the present, and to provide for the growth of the collections. It is to be of brick on a deep substructure of granite, and the estimated cost of construction and fitting up is about 165,000*l.* Towards this about 7,000*l.* has been contributed, and decorative materials (originally designed for a palace) to the value of upwards of 3,000*l.* have been given by members of the Royal Family. The Committee will not commence building till 30,000*l.* is in hand, and towards raising this sum they intend to hold a lottery at the close of the present year, to consist of three million tickets at one krona (1s. 2d.) each, and they appeal for help in the way of articles for the lottery, or of money, "to art-loving English men and women." We fear the method adopted will not much commend itself to the English mind. Those, however, who think the end sanctifies the means, or who are superior to insular prejudices, have thus the opportunity of assisting. Contributions of any kind will be received by the Swedish Minister, 47, Charles-street, Berkeley-square; or by Sir Philip Cunliffe-Owen, at the South Kensington Museum.

THE offer of the Ecclesiastical Commissioners, made through Lord Stanhope to the last meeting of the Court of Common Council, "to appropriate for the perpetual use and enjoyment of the inhabitants of the metropolis sixty-nine acres of wood at Highgate and thirty acres of land at Kilburn," was unanimously referred to the Coal, Corn, and Finance Committee for consideration, but with every symptom of approval. The growing need of the vast population of London for open spaces, secured in perpetuity for recreation and fresh air, and saved from the inroads of the speculating builder, cannot be too strongly insisted upon, and the gift is a wise and well-timed one. It is available subject to the sanction of Parliament to the proceeding, and the undertaking of the Corporation to maintain these two spaces as parks in perpetuity. The latter condition we have no doubt the Corporation will be willing to fulfil. About the former there may be a contest, possibly. Clerical writers in the daily papers appear to think that the scheme involves an alienation of their rights. "This would be scanned," of course; but the consideration of the greatest happiness of the greatest number points in the other direction, and those who may be eventually in full enioyment of the Highgate woods and their health-giving influence will, perhaps, be apt to dismiss the clerical claims as shortly as the man in one of Leech's old hunting scenes: "Who's that come to grief in the ditch?" "The Parson." "Never mind, we shan't want him till Sunday."

THE returns relating to all authorised gas undertakings in the United Kingdom, which have been recently printed, enable us to take a bird's-eye view of an industry which, for its magnitude, is unquestionably the most prosperous of any carried on within our shores. Nor is the magnitude contemptible. Out of sixty-nine millions sterling authorised, fifty-two millions have been actually raised in shares and loans, of which 18 millions come under the control of local authorities, and thirty-four millions under that of companies. The sums paid as interest or dividend are not included in the returns; but the receipts of the local authorities amount to 4,252,296*l.*, and their expenditure to 2,877,732. As to the companies, ten per cent. is in most cases fixed as the maximum rate of dividend, but eleven and twelve per cent. have been not unfrequently divided. The total tonnage of coal carbonised is 7,631,304 tons; a quantity almost exactly equal one-third of the total quantity exported in 1883. Ten thousand cubic feet of gas have been produced from each ton of coal, on the average. The consumers of gas are returned at 2,019,846, which we may take to represent rather more than 10,000,000 individuals, as the number approaches very closely to that of the houses in Parliamentary boroughs, which were 2,096,497 in 1881. At this rate gas capital is rather more than 5*l.* per head for our urban population, each member of which will have been furnished with the gaseous product of 15 cwt. of coal, at an average cost, probably, of from seven to eight shillings a year, including public as well as private lights. The annual value of the property assessed to income tax, in gas works, in 1882, was 4,640,363*l.*, but it is not apparent whether the returns of the local authorities are included in that amount.

THE Revenue Report of the Irrigation Branch of the Public Works Department in the Government of Bengal has just been issued. From it we take the following figures. The total area irrigated during the years 1883-84 was 497,293 acres, of which 350,614 acres are situated in the province of Behar, within the limits of the system comprising the Sone Delta scheme; 48,760 acres in Orissa proper, and 97,919 acres in the Midnapore series. The irrigated area in the Sone system was double that in the previous year, while Orissa shows only one-half, and Midnapore about 4,000 acres less than in 1882-83. The diminution in Orissa is ascribed to the fact of the greater portion of the five-year leases having fallen in, and an expectation on the

part of the cultivators that by holding aloof they would be able to obtain lower rates from the Government. The receipts aggregated nearly 117,000*l.*, of which about 72,700*l.* were paid for water, and 37,820*l.* were navigation tolls. The working expenses were 107,000*l.* The Lieut.-Governor considers the results of the year, in a financial point of view, unsatisfactory. A commission has lately been appointed to inquire into the administration of the Orissa canals, and to report on the actual profits derived from the works, independent of the share received by Government, and their inquiries will afford grounds for coming to a conclusion as to the propriety of endeavouring to secure for the State a larger share of the benefits reaped.

ON seven of our principal railways there has been a decline in both gross and net revenue for the year 1884. On three there has been a fractional increase; and on two, namely, the London, Brighton, and South Coast and the Great Eastern, there has been an increase of respectively 14,500*l.* and 37,000*l.* in net revenue. The diminution in the aggregate receipts of the twelve lines has been 1½ per cent. The working expenses have been reduced by rather less than 1½ per cent.; and the result is a decrease of 1¾ per cent. in the net profit for the year. To that has to be added the charge for additional capital, which has yet to be shown. With a declining revenue the proportion between increase and expenditure has been very fairly maintained, the proportion of working expenses to gross revenue having been 51·44 per cent. in 1884, against 51·29 per cent. in 1883. The result is the more discouraging, as the increase in gross revenue has hitherto been steady since 1879, the amount for 1883 being 9¼ millions sterling more than that for 1879. The net receipts have not advanced *pari passu*, having been 50,000*l.* less in 1882 than 1881; but they were more by 5½ millions in 1883 than in 1879. The proportion (over the whole of the railways of the United Kingdom) of net revenue to capital in the last five years has been:—1879, 4·15 per cent.; 1880, 4·38 per cent.; 1881, 4·26 per cent.; 1882, 4·32 per cent.; 1883, 4·29 per cent.

AN interesting letter from Athens in last week's *Athenæum*, by Mr. S. P. Lambros, deals with the question of the demolition of some of the Turkish buildings on the Acropolis, in order to bring to light portions of ancient Athenian structure which have been hidden by these late additions. Mr. Lambros specially refers to the demolition of the Byzantine cisterns which abutted on the eastern side of the Propylæa. The removal of these has brought to light various fragments containing reliefs and inscriptions, one of the latter being of great interest. Mr. Freeman has, it appears, written strongly against this and other demolitions of Turkish work on the Acropolis as interfering with and obliterating historical records. This is, of course, in itself to be deplored, but we must consider the matter with due regard to the relative value of the remains. We cannot think that Turkish utilitarian structures of the seventeenth century are in any way comparable in value to ancient Athenian remains, and their demolition, if it gives place for a fuller study of the latter, is gain both to history and archæology. Mr. Lambros, who argues in this sense, has, we think, quite made out his case.

SOME interesting discoveries have just been made at that remarkable building, the Great Yarmouth Tolhouse, now in process of repair under the supervision of the architects, Mr. E. P. Loftus Brock, F.S.A., of London, and Messrs. Bottle & Olley, of Yarmouth. The whole of the rough-cast which has for many years covered the old walls, giving to the building a very modern appearance, is being removed, thus opening out to view the ancient walling. A series of pretty arches of early fourteenth-century work, supported upon neatly-cut corbels, has been found, hidden hitherto by the plastering, just below the open porch from which proclamations and addresses used to be made. Below this, again, has been found and opened up the arched opening which once let light and air into the "Hold," a dreary prison, partly underground, into which offenders of all sorts and ages were thrust in former times, and chained to a central beam. The opening had been enlarged roughly at the expense of the arcading, much of which had been cut away for the purpose and walled up at a much later period. This very interesting feature of the fabric will be carefully repaired. Indeed, the effect generally of the works in progress will be to make this curious building appear more ancient than it did at their commencement. The old roof has been opened out, and it is intended to fill the side windows with armorial glass of the old local families.

FROM the *Gazette des Architectes* we learn that the following gentlemen have been appointed as officers and council of the "Société des Amis des Monuments Parisiens":—President, M. Albert Lenoir, Member of the Institute of France; Vice-Presidents, M. Cernesson, architect, former President of the Municipal Council; M. Franklin, Chief Administrator of the Bibliothèque Mazarine; and M. de Montaiglon, President of the "Société de l'Histoire de l'Art Français"; General Secretary, M. Chas. Normand, architect; Assistant Secretaries, M. Alfred Lenoir, sculptor; M. Maignan, painter; and M. Mareuse, Secretary of the "Commission des Inscriptions Parisiennes"; "Archiviste," M. Muntz, Keeper of the Museum and Library of the "École des Beaux Arts." The Society has its quarters at 215, Boulevard St. Germain.

THE current number of the *Antiquary* contains the second instalment of an interesting series of articles by Mr. W. Carew Hazlitt on "Venice before the Stones." The author has collected much interesting information as to the original condition and the artificial formation of the ground from which the city of the sea was to rise. "The true foundations of Venice," he observes, "were laid by men who ate and slept like the beasts of the field, and whose wages were their daily bread and the grace of life.* The free work we see, but the other lies beneath us, wherever we move: a gigantic task of preparation by such as knew not for what they were making ready, nor cared." Repeated entries on the proceedings of the General Council, particularly in 1303 and 1305, show that the directing authorities, however, spared no trouble in securing a firm bottom everywhere, and that "a considerable part of the capital and the adjacent islands rests on made ground of a date much posterior to the natural uprise of the lagoons; and this may be taken to be the true interpretation of the term *fundamentum* or *fondamento*, which we find so frequently applied in documents to established routes as well as to prepared sites for building, and which survives in the modern nomenclature."

ACCORDING to the *Courier de l'Art*, M. Ambroise Tardieu has discovered, over a confessional in the little church of Herment, a small town about thirty miles from Clermont, a painting, which he believes to be a hitherto unknown work by Guido Reni.

WE do not know to whom we are indebted for the trees with which the southern end of Gray's Inn-road is planted, whether it be to the Metropolitan Board or the Holborn District Board, but we would like to call the attention of the authority responsible for their planting to the extremely ugly supports which have been placed around these trees. The supports are of wood and are unnecessarily thick and clumsy, and are certain to be destroyed in a short time. A light iron guard of a simple character should be substituted, and the galvanised iron netting which at present protects the trees should be replaced by something of a more permanent character.

* Hardly so much "grace," in Falstaff's phrase, "as would be prologue to an egg and butter," one may suppose.

OUR readers may remember that a short time back we made note of a case of building with bad mortar, which took place at Hackney. In August, 1882, proceedings were taken by Mr. A. Payne, the District Surveyor of East Hackney (South) and North Bow, against Simeon Muncey, the builder of two houses, who was fined 3*l.* and costs for not using proper mortar. As he made no alteration to the structures, the Metropolitan Board of Works proceeded still further against him, and the Magistrate made an order that the houses should be taken down. The defendant then appealed to the High Court of Justice, having in the meantime mortgaged the property. The Magistrate's ruling, however, was confirmed, and judgment was given for the Board, and, after great delay, by an arrangement with the mortgagees, all the parts built with bad mortar have been taken down. In the interest of the public, there is no doubt that houses built with bad mortar should be levelled to the ground. It is to be regretted, however, that under the present system of building the mortgagees may, in such cases, chiefly suffer, while the builder, who certainly deserves punishment, escapes practically free. But it is also true that there are other cases in which the builder is a mere dummy to shield some real owner, who carefully keeps his name and ownership out of sight so as to escape the penalties of the Building Acts.

IN view of the proposed change in reckoning the hours of the day, from 1 to 24, instead of by two twelves (which we are inclined to believe will be tacitly adopted before very long), Mr. T. R. Weston has taken out a provisional patent for affixing to any watch or clock face, divided on the present system, a ring of thin enamelled card, bearing in red numerals the hours from 13 to 24; the ring falling within the outer circle of hours as at present marked. This will render the renumbering a matter of easy application to any watch or clock face of ordinary size.

THE respective Mayors of Birkenhead and Liverpool formally shook hands, on Friday, the 13th, in the middle of the Mersey Tunnel, signalising by this ceremony the completion of this valuable and successful piece of engineering. We gave a detailed account some time ago of the method and progress of the operations, and will shortly illustrate the new stations which are being erected over the two ends of the tunnel, from the designs of Mr. Grayson. The tunnel will not be actually open for railway traffic for some little time yet.

RECENT DISCOVERIES IN LYCIA.

A FULL account of the splendid and costly work, in which is embodied the official report of the first Austrian expedition to Lycia, has already appeared in the pages of the *Builder*.* We are glad to be able to point out that a small popular volume† has appeared almost simultaneously, which deals with such aspects of the expedition as struck the non-professional mind. This small octavo, with its abundant excellent illustrations, may be obtained for as many shillings as the official folio costs pounds, and it should be in the hands of all who care to study both sculpture and architecture in their relation to topography. Baron Warsberg is already known by his "Odysseeische Landschaften" (including Corfu, Epirus, Ithaka, Cephalonia, Zante), and he promises us forthcoming books of a similar description, with views of Thracian, Mysian, and Bithynian landscapes. He feels very rightly that all students are too apt to take the *museum* view of the remains of ancient art, to think habitually of fragments of sculpture and architecture as they now lie in dark museums, rather than to picture them in their original tectonic and topographical surroundings. A little effort is needed to think back the old circumstances, and the effort is gladly shirked. We have ourselves met with students of Greek art who were well versed in the many and conflicting theories as to the

* See p. 127, *ante*.

† "Homerische Landschaften." Von Alexander Freiherr von Warsberg. Erster Band. I. Das Reich des Sarpedon. II. Rhodos. III. Im Ægäer Meer. Wien: Carl Graeser, 1884.

interpretation of the sculptures (to take a Lycian example) of the so-called Harpy tomb in the British Museum, who yet had formed no image, however shadowy, of the beautiful Xanthos valley where they once stood, no, nor even of the height and shape of the pillar-like tomb from which they were rent. The Berlin Cast Museum has found it possible to surround the walls of each different "Saal" with paintings of the surroundings of the sculptures arranged below, the landscape of valley or mountain, and sometimes when possible the reconstruction of the monument. Till something of this sort is possible in England we must welcome the more eagerly illustrated books of topography. It is not the least our purpose even to summarise the contents of Baron Warsberg's book; he writes in a pleasant chatty style, telling always as much of the history of the place as is necessary for the understanding of its monuments; he was one of the few eager enthusiasts (would there were more of the same sort) who met in Dr. Benndorf's drawing-room on that memorable evening of the 24th of March, just before the expedition started, and he tells in German fashion how eager was the enthusiasm then kindled in his heart, and how indomitable the vitality of the good "seed then sown." Wherever Dr. Benndorf went, he went with Homeric associations ever present in his mind; and in the twenty-one plates interspersed in the book he has left us the landscape background to many a Homeric action. Some of these plates we recognise as the same as those in the large work of Dr. Benndorf, and we are glad they should thereby obtain a wider circulation. Three relate to the Djölbaschi Heroon, as yet left untouched by the official account. They give the entrance to the Heroon, the friezes on the inside of one wall, and the magnificent view seen from the hill on which the monument stands.

Naturally Baron Warsberg is strong on the method by which the expedition was set on foot; it was, as we have already had occasion to note, a *private* enterprise, not a Government undertaking; the Austrians are, as opposed to the Prussians, strong on the subject of *self*-government. Like the English, they are apt to reduce the functions of State government to the lowest practical minimum. For archæological, and, indeed, all scientific enterprise, Baron Warsberg thinks the private system is preferable, but, then, he is an Austrian. For ourselves, with the Prussian excavations of Olympia and Pergamos before our minds, and the inertia of England as a contrast, we are not so sure. Anyhow, there is room for all.

ROOF COVERINGS.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

At the ordinary meeting of the Institute, held on Monday evening last, Mr. Alfred Waterhouse, A.R.A., presiding, the death of Mr. John Middleton, Cheltenham, Fellow, was announced.

Mr. Ralph Nevill, F.S.A., read a paper on "Roof Coverings." After stating that it was very difficult to obtain from the older members of the profession, who were in full working, long and exhaustive papers on any subject, Mr. Nevill expressed his conviction that considerable benefit would result from the discussion of subjects of practical interest, introduced in short papers requiring little preparation. He could not attempt to deal exhaustively with so large a subject, and would confine himself to what he could speak of from practical experience. Nearly all roofs in rural districts were constructed either of tiles or slates, the former being superior from the point of view of picturesqueness and non-conduction of heat; the latter from that of cheapness and closeness of fit. In the great snowstorm of 1882 there was scarcely a single tile roof which kept out the snow, and this had caused him to endeavour to find some easy method of meeting the difficulty. After alluding to the general plan of securing tiles to laths, and showing how liable the laths were to split, reference was made to the old plan of bedding tiles on hay, and its objections were pointed out, as also the serious drawbacks to bedding in mortar. The various ways of laying felt under tiles were next described, and the objections to its use noted, viz., its liability to stretch, the likelihood of its causing the rafters to rot, and its short durability. Mr. Nevill then described the plan adopted by himself. He advocated covering the backs of the rafters with 1 in. of concrete or plaster, in which the pins for the tiles could be fixed, the plaster being laid on the laths in the ordinary way, 3-in. rose-nails being first driven into the backs of the rafters, standing out 1 in., care being taken to keep these nails out of the line of the tile-pins. The plaster or concrete should be made of selenitic lime, mixed with coke breeze and sand, as it was essential it should set quickly, and it should be trowelled to a smooth and hard face. Before the plaster had quite set, the tiles should be laid, the pins being pressed into the plaster, and it was important that the pins should not be more than 1½ in. long. Should the plaster have become too hard, the pins must be driven in with the hammer. The eaves-lath should be 1½ in. thicker than usual, in order to stop the plaster; the valleys should be carefully trowelled, and the hips would require a raised roll. No practical difficulty occurred in the case of chimney-stacks. It would be apparent from this description that there would be a coat of concrete all over the roof, which would throw off any damp that might penetrate through the tiles, and would make the rooms underneath much more equable in temperature. Specimens of concrete plaster that had been used were exhibited, and the advantage of such a roof in preventing the spread of fire was pointed out. Objections might be raised on the score of increased weight, but Mr. Nevill had not found it necessary to increase the scantling of roof timbers. It might also be thought that the timbers would decay for lack of ventilation, but hitherto no signs of such decay had appeared in roofs thus treated. The cost, as a rule, would not be more than 14s. per square above ordinary tiling, and several tables of comparison had been prepared. Mr. Nevill concluded by referring to the advantages of this system of laying tiles in the case of the larger tiles, such as pantiles, Phillips's, &c.

Mr. W. G. Coldwell next read a paper on the same subject. He said that after an inspection of the districts in Essex affected by the earthquake in April last, he was profoundly impressed with the want of security of the plain tile roofing. The tile roofs had come down almost *en masse*, and it was evidently most desirable to adopt some system of laying tiles different from that now in vogue. With reference to lead, no more important subject for discussion could be suggested than the deterioration in the quality of lead as now supplied. In the case of the lead-covered roofs over an important building, which was examined some few years ago, it was found that on the underside of the lead, which was laid on boarding, a film of white powder existed, in lines corresponding with the joints of the boarding, thus indicating that injurious action had taken place below. Dr. Frankland, who examined this lead, found that the white powder was white lead, and it was probable that the modern de-silvering process really rendered the lead more liable to injury from acidulative vapours, than the other process which did not remove so much silver from the ore. Various methods of covering iron roofs were alluded to by Mr. Coldwell.

Mr. McLachlan gave some extracts from a report he had made when holder of the Godwin Bursary. The roofing materials used in North Germany were tiles,—plain and ornamental; slates of English and German fashion; corrugated iron, galvanised zinc, copper, lead, asphalte, roofing paper, felt, and wood-cement. In the case of tiles, the effect of some of the German roofs was very good. The laths were laid from course to course, and on each lath was hung a double row of tiles, the upper being supported by the lower course. There was always a thickness of two tiles, and, in parts, even of four tiles. The heavily-weighted laths were from 1½ in. to 2¾ in. wide, care being taken in the selection of the wood. The church of St. John, Altona, was roofed with plain tiles, and some of the German churches had colours laid in patterns. German tiles were 4 in. or 5 in. longer than English tiles. Slates had only been introduced as a roofing material in many of the North German towns during the last fifty years. In several cases Welsh slates were now used; the German mode of laying slates being in oblique courses, similar to what could be seen at the Law Courts. Copper appeared to have been chiefly used for public and municipal buildings of the first class, especially spires and domes. Zinc was now perhaps the material most extensively used for covering buildings, where it was a matter of no great moment that there should be an equable temperature beneath. Forty years ago it was unknown in Berlin for roofing purposes, but was now used there to a very great extent. Galvanised corrugated iron was extensively used for the roof coverings of the new prison buildings in Hamburg. He had not seen a single instance of the use of lead for roofing in Germany, and he was told that it had been superseded by zinc and copper. Roofing paper was largely used for buildings where great economy was desired; it was necessary, however, to re-tar it every two or three years. Wood-cement was one of the most important roofing materials in North Germany, and appeared to be in a fair way of superseding other materials.

Mr. John Slater said he had had some experience of the roofing-paper and the wood cement. He had superintended the erection of a brewery built by a German contractor, who had used the stuff largely. He was afraid it would not last, but it had lasted well and produced an equable temperature underneath. They had worked up to the idea of sowing seeds on the *holz*-cement, but the gravel was washed away and the gutters and pipes became clogged. He could have wished that Mr. Nevill had had a larger experience of the roofs described by him. That they were very impermeable went without saying, but they must be extremely heavy. Through differences of temperature and the variation of the wind, roofs had a certain amount of spring, and it would be curious to ascertain whether this affected Mr. Nevill's roofs. If it did, the probability was that the cement would crack in a great many places. It was interesting to notice how closely alike in form and character some of the new patent tiles were to the old Roman and Mediæval tiles. Tiles were doubtless used for roof-covering at an early period, and the probability was that the early Roman tiles were made with a ridge on on side and a notch on the other, so that the ridge fitted into the notch vertically. They also ran up a series of hollow tiles which overlapped and covered the vertical joints. He believed an improvement of the principle was made by having tiles of a trapezoidal shape, fitting closely to those underneath. With regard to Mediæval tiles, no better had been made than those used in Champagne for buildings of the thirteenth and fourteenth centuries. Some which could be seen in the neighbourhood of Troyes were very carefully made, and the exposed parts were sometimes slightly vitrified. One thing in connexion with the Mediæval tiles might be adopted in modern ones,—viz., the chamfering off of the end of the tile, which largely diminished the risk of the roof being stripped off by wind-pressure. The question of wind-pressure on roofs was an interesting one and deserved an evening for itself. He proposed a vote of thanks to Mr. Nevill for introducing the subject.

Mr. W. H. White (Secretary) said that no reference had been made to the French system of using hooks for slates instead of nails. It was usual in English specifications to stipulate for copper nails, but, during the last twenty-five years, in all French buildings of any importance slates had been hooked and not nailed. A copper hook was used, so that when the wind played against the side of the roof it simply blew under the slates, and rattled, without destroying them. M. Viollet-le-Duc was, he believed, the first to introduce these hooks. Even twenty years ago he (Mr. White) had the advantage of seeing them at Cherbourg, a town which was very much exposed. There he had seen part of the roof of a château destroyed by the wind when the slates were simply nailed, but, when hooks were substituted, the wind had no injurious effect whatever. With regard to Mr. Coldwell's remark as to the effect of the lead on timber, he could recall a visit which Mr. Roger Smith and he had made to the dome of the Invalides when it was being repaired, seventeen years ago. The lead was then being taken off and they found half an inch of the greyish powder referred to between the lead and the oak battening of the dome. Mr. Nevill had suggested that our roofs should be concreted, but he might say that the French had adopted this plan for a considerable time.

Mr. E. G. Paley referred to the danger of using felt under the slates. On one occasion he found the common inodorous felt had been fired by sparks from a chimney. Mr. Nevill's suggestion of using concrete was a most important one, and unless the weight and expense were serious

it certainly seemed to be the right thing. Mr. Nevill appeared to be wrong in one respect, in regard to slating. If well fastened with copper nails on good battens, and afterwards pointed, he believed slates were perfectly impervious to the finest drizzle or snow. A slate well put on and pointed would really last for ever, and in that respect was perhaps the best possible roof-covering.

Mr. Brodie asked Mr. Nevill what was the cost of repairing his roofs?

Mr. Alexander Payne had prepared the following paper on the subject:—I was only asked on Saturday last by the Secretary to write a short paper on the "Employment of Concrete for Roofs and Roof Coverings" as a corollary to Mr. R. Nevill's paper. I may be allowed briefly to recapitulate what I have already said in this room on this subject. In the volume of the Transactions for session 1874–75, p. 183, as an appendix to Mr. C. H. Driver's paper on "Iron as a Constructive Material," will be found some remarks accompanied by an illustration on concrete combined with iron as applied to the construction of vaults and domes, and I believe I am correct in saying that the most important fireproof domes of large span which have been constructed in this country since that date have been constructed on the system therein indicated, viz., of concrete with iron ties embedded to resist the tendency to spread. Perhaps the largest is the dome over the Oratory at Brompton, by Mr. Herbert Gribble. I believe the dome over the Greek Church, in Bayswater, is constructed of concrete in the same way, but I am obliged to trust to memory here, as I cannot find my notes of its construction. In 1876 I had the honour of reading a paper before the Institute on concrete as a building material, which dealt chiefly with walls and ornamentation, but roofs and vaults were also alluded to, and illustrated by some examples. In treating of concrete as a material for roofs and roof-coverings, it may be as well to limit the subject at once to those instances in which the employment of such a material would be of practical advantage. For the ordinary pitched roof of the general run of buildings we are not likely to see concrete much employed, except in the form of concrete tiles or slabs, on account of its great weight, and the consequent expense of both the roof itself and its supports. We may also, I think, lay it down as a rule that concrete, if employed, would be not only used as a covering, but would itself form part of the construction of the roof. The following appear to me to be cases in which concrete may be advantageously employed in roofs:—1. For flat roofs. 2. For all kinds of fireproof roofs. 3. For all kinds of domes and vaults. 4. For the roofs of all buildings of a monumental character in which great strength or durability is required. As an example of the first kind, viz., flat roofs, I may mention one which has come under my notice as District Surveyor in my district at Hackney, where Mr. H. M. Millar, builder, is erecting some small houses in which several ingenious applications of concrete are adopted. He forms part of the flat roof as follows:—The top story is covered by joists 8 in. by 3 in. at one end and 3 in. by 3 in. at the other, made by cutting through a 11 in. by 3 in. joist diagonally so as to get fall without waste, placed about 12 in. apart; these are covered by boarding in 2½ in. widths and ¾ in. thick, each board being ¼ in. distant from the next one (a very important point, as if laid close they swell with the wet, spring up and break the roof). On this, as centering, is added 2 in. of Portland cement concrete as a roof-covering; the concrete is made of brick rubbish, ground to powder in a mill; one quarter in bulk of Portland cement is added, thoroughly mixed dry, and then wetted and brought to the consistency of a thick paste; it is laid on the boarding, smoothed over with a trowel, and the roof is complete,—a coat of tar is sometimes added, but is not absolutely necessary. Mr. Millar says he has had about eight years' experience with roofs of this kind, has made about fifty, and has never had a failure, except in the case of some which were done during a frost. More frequently the centering boards are put under the joists, embedding them in, and thus making the roof practically fireproof. I believe this is a method frequently adopted in the roofs of artisans' dwellings in the East End and elsewhere. It is quite obvious that in buildings of greater importance the same system might be adopted with iron joists instead of wood; or any of the numerous methods in use for the construction of fireproof floors in concrete would come in also with slight variation as useful flat roofs, and no doubt many of the members present could give examples of such application. 2. The same reasons that make concrete available for fireproof floors make it also available for fireproof roofs of all kinds. Suppose a fireproof roof be required, and it is determined to cover the building with a roof on the Mansard principle. Let all the principals be formed of iron trusses, the front and back walls of the attic story being framed of suitable iron uprights, instead of the usual wooden quarterings, and let the common rafters be of iron; put boarding on each side of these rafters and quarterings to form a mould, and fill in with fireproof concrete, so arranged as to cover and protect the iron, and you then have a complete fireproof roof without thrust on the walls, which is neutralised by the trusses. I have noticed in houses in the course of construction in Paris that all the roof framing and common rafters are frequently of iron, and it would be interesting if our secretary, or some other gentleman equally well acquainted with French construction, could tell us in the discussion if this iron framework ever has a concrete filling-in like the fireproof floors which are so general in Paris; [The Secretary: Always.] and also some member may possibly be able to inform us if this mode of construction has been adopted in America. 3. On the subject of domes and vaults, I think I have little to add to what I have already said in the former papers above alluded to, so that I will not take up the time of the meeting by going into it, except to allude to the immense importance of the subject and its bearing upon the whole question of style and construction in architecture. To realise this, one has only to turn to a work like M. Viollet-le-Duc's Dictionary, and glance at the chapter on vaults in the article on "Construction," where he shows, in that lucid, analytical style which is peculiarly his own, how the whole fabric of the Gothic cathedral rose up step by step from the repeated attempts after many failures to cover in those large buildings in a fireproof manner with stone vaulting. We know how the Gothic architects ultimately succeeded by an ingenious collection of the various thrusts of the vaults in given points, and opposing these by buttresses. Wonderfully ingenious and skilful as this method is, I think it must be admitted that it carries with it the elements of unrest and of comparatively early dissolution; in most instances, if one pier or one buttress gives way, the rest will follow at no distant date, like houses built of cards; it is to be doubted if buildings on this system, unless constantly watched and repaired, will ever attain the ages of those of Egypt and Greece, constructed on the principle of the upright support and horizontal lintel; and, is it not quite possible that if the ingenious and practical designers of the Middle Ages had had at their disposal iron in large bulk, worked with the ease and facility that it is in modern times, and a strong and plastic material like Portland cement concrete to use in conjunction with it, that the problem of roofing in large buildings in a fire-proof manner might have taken a totally different direction to the buttress system of equilibrium between thrusts and dead weight which so characterises Gothic vaulted buildings? I am now trenching on my fourth heading, viz., the suitability of the employment of concrete for roofs of buildings of a monumental character where durability and fire-proof construction are required, and in proof of this, I think I need only refer to the examples of splendid buildings erected in India, both in ancient and modern times, some of which have been described and illustrated in the Transactions of the Institute, and in which concrete figures certainly as the chief material in the construction both of roofs, vaults, and domes.

Mr. Blagrove mentioned that there were no iron ribs in the dome of the Oratory at Brompton, concrete only being used throughout.

Mr. T. Blashill remarked that he much preferred good large fillets to flashings, where the roof came against the wall or chimney, for with the most carefully put-on flashings the water would come into the house. It was not so easy to put soakers under the edge of the tiles as it was to put them on the slates; but if a good fillet were put upon the edge of the plain tile roofing, it generally held well.

Mr. J. Macvicar Anderson (Hon. Secretary) considered that, instead of using ordinary tile fillets, the better course was to cut a small chase in the brick-work, to let the tiles into the chase, and to make any slight settlement afterwards good with cement. Lead flashings on a tile roof were an abomination.

The Chairman, having seconded the vote of thanks to Mr. Nevill, it was carried.

Mr. Nevill, in replying, said that he had tested a great number of buildings with these roofs, but in no case had he found the least sign of any sagging. As to repairs he had found no difficulty, because, if a tile snapped in the middle, it could be taken out and replaced in cement. He had not meant to say that slates were pervious to snow; on the contrary, he gave them the advantage over tiles in that respect.

MEDALS.

ON Wednesday evening last, Mr. R. S. Poole, LL.D., delivered a lecture to the students of the Royal Academy on the "Art of Medals." The lecturer said that medals were commemorative, and should therefore hold a great place in art. They commemorated the deeds and faces of great men, and were much more generally diffused than statues or pictures. Medals may either be produced by the process of striking or that of casting. We may at once reject the struck medal from its mechanical character, and select the cast as the one to be described. We give this preference to the cast medal from the possibility and scope it affords the artist for skilful and true work, owing to the process it undergoes in its production. It is also a far cheaper method than the other, costing one-third or one-half as much. In a struck medal the expense is owing to the mechanical part of the work, and in a cast the honorarium for the artist's labour is the main outlay. This art is not taught at any of our great artistic schools except the Slade, and Professor Legros and Miss Hallé are perhaps the only teachers of the art of medal-working. The production of a medal can be performed in either of the two following ways:—First, you may model your medal in wax: from this wax you may get a succession of plaster moulds and proofs, and from the last plaster essay the final mould itself; otherwise you may make the wax model your final work, and the mould may be produced from it, or it may be converted into a medal by the process *à cire perdue*. The tools generally used in making a medal vary in their material as the substance worked upon. For work in plaster steel tools are used; for wax, wood; but, as often as not, in the finishing work of the wax medal, steel should also be used. The shape of the tool used is really a matter of taste, and provided that the worker used something with which to work the right curves, a blunt needle or penknife answered the purpose as well as anything else. The method adopted by the Greeks is remarkable, as they made dies of hard steel, and worked them, like gems, with the wheel. And now, leaving the mechanical side, and turning our attention to the artistic, we find that relief is necessarily adopted, and it is this feature that enables us to place the medal as a sort of connecting link between the picture and the statue. Thus we find that in ages when painting was the leading art, relief, and in consequence the medal in all its principal features, showed its relationship to the picture, and when sculpture predominated medals followed the lines of sculpture. For the three kinds of relief, bas-relief, high, and mezzo, we cannot do better than accept Sir Charles Eastlake's definition. He says that bas or low relief is used where there is a bad light. It therefore requires strongly-marked and clearly-defined drawing for its principal outlines. High or alto relief is generally to be seen in the open air, and has its own shadows as well as those cast upon it; it must, accordingly, be treated largely and very simply. Mezzo-relief was used by the Greeks for objects near the eye and in a good light, an instance in point being the chariot frieze of the Mausoleum. The metals used by the Greeks for the purpose of making medals were four in number; gold, silver, electrum, and bronze. Of course, it is not possible to command an unlimited supply of gold for purposes of working now, but it should be remembered that when bronze is used for this purpose, as it almost invariably is, due regard should be paid to the character and substance of the metal in the nature of the

production. As regards the shape of a medal, it should, above all things, be natural, and not mechanical: it should bear evidence in all its details of the presence of the human hand. In Italian medals, we can almost see the gradual formation of the rim, which was not clearly defined in the first instance by a pair of compasses. The surface should not be a dead surface; in Greek work we find the obverse convex and the reverse slightly concave. The importance of this relief in the surface is due to the fact that from the shades of light cast we practically get air, and even colour. The two sides of the medal should be harmonious; and this was a fact recognised largely by the Roman and Greek artists: thus we find the head of a divinity on one side and something relating to his myth on the reverse. In order to understand as nearly as possible this harmony of the two sides, it is better to note the obverse and reverse side by side. There are two positions in which the head is depicted on a medal, either three-quarter face or in profile; the former belonging to the purest age of Greek art, namely, from B.C. 420—330, or, roughly, from the age of Pheidias to that of Lysippus. The finest period of Italian medal work is also characterised by the three-quarter face. The profile is easier than the three-quarter face, and presents less difficulty. The great point of difference between the Greek medal and the Italian is that, while the Greek sought to represent beauty in as perfect a form as possible, the Italian's aim was to give us man as he was and could be: he could depict all the stages of existence. Thus the Greek sought to represent measure and the elimination of all that was disagreeable to him; the Italian was absolutely true and natural. The lecturer then briefly criticised the Greek and Italian diagrams, drawing particular attention to the simplicity of the head-dresses and the accessories, which, he said, should not be thrown in vaguely and without discrimination, but should be typical. The border might be either of the fillet type or a wreath. With respect to the inscription, the letters should carry dignity, be solid, and slightly rounded, as though the limbs were of cylindrical shape. In conclusion, the lecturer drew attention to the importance of combining work from the model with a due observation of the antique, and of producing work from memory rather than by trusting to a mere system of copying.

LECTURES TO ARTISANS AT CARPENTERS' HALL.

THE COMPARATIVE ANATOMY OF BEAMS, TRUSSES, AND ARCHES.

As we briefly announced last week (p. 254, *ante*), Professor Kerr on the 11th inst. gave the first of a series of free lectures to artisans, in the great hall of the Carpenters' Company, taking the above-named subject as the theme of his discourse.

The lecturer commenced by asking his audience to suppose that the carpenter's rule he held in his hand was a beam loaded so heavily on the middle as to be overstrained. They all knew what happened: it began to deflect more and more until it opened at the soffit and became fractured. At the same time it became buckled at the upper surface. If he took a bar of iron instead of a carpenter's rule, and supposed it to be overloaded, it would deflect very considerably, the material being highly elastic, and while the under side became extended, the upper side became perceptibly crumpled. This showed that the lower part of the beam was in tension, and the upper part in compression. The strength of a beam was in direct proportion to its breadth, because two beams put together would carry twice the weight. But it was as the *square* of the depth, so that the depth was of the principal value. In considering these facts they would find all kinds of materials tabulated in respect of strength, and they would get into the system of adjusting sectional areas at the top and bottom of a beam so that it should be equally strained in the two capacities of compression and tension. The resistances of timber against compression and tension did not vary sufficiently to induce them to interfere with the simplicity of the square or rectangular section. But cast iron resisted tension with only one-sixth of the force with which it resisted compression. Thus they required a very different section from the rectangular one, and they had the utmost strength that the material could offer in a complicated section, based on the relative strengths of this particular material as against compression and tension. If, on the other hand, they were dealing with a wrought-iron joist, the top and bottom flanges were equal, because the strengths were as nearly as possible the same. The web had only one function; it had nothing to do but to maintain the element of depth. With regard to stone, as long ago as the time of the Romans, when large stones were used as lintels, they made use of discharging arches. Concrete was a better material, and here he would mention a proposition he was accustomed to lay before his students at King's College. It was this: Nature did not undertake to find us in building materials. Building is a highly artificial performance, and nature expects us to improve on the raw materials in order to make them suit our artificial purposes. Thus concrete ought not to be looked upon as an inferior makeshift for stone, but as a superior artificial material. The cementing medium was stronger, while the bonding of the particles was also better, giving a sort of fibrous character to concrete which stone could not possess. The Professor then referred to tubular iron bridges as exhibiting the perfection of scientific design, returning to the primitive form of a plain rectangular beam, with its upper surface all in compression, its lower surface all in tension, and the walls serving only to maintain the d-square against cross-strain. He then showed how the plain timber beam in side elevation became converted into the form of a truss, by cutting out superfluous material, leaving the equivalent of a pair of rafters in compression, and of a tie in tension, with the same d^2 as before, maintained no matter how, but the former cross-strain being now abolished, that is, converted into the more favourable strains of tension and compression. Out of this the regulation king-post and queen-post roof-trusses of timber, and the same in iron, were easily developed, the d^2 being always the chief element of strength. The unscientific roof-trusses of the Mediæval period were also illustrated, and the origin of true trussing in the sixteenth century shown by drawings. Braced and latticed girders, and the simple Warren girder, were here again a return to the primitive form of a solid timber beam, with the d^2 in simplicity. Thus it was manifest that the truss, of whatever kind, was only a beam after all, with the top portion in compression, the bottom portion in tension, and the depth made the most of for the sake of the strength being as the square of it. The lecturer proceeded next to show how a scientifically perfect truss is made by two pieces of cane spreading asunder at the foot, and restrained by a piece of string; and then converted this at once into an arch, by substituting a single piece of cane, brought up to a curve by the same piece of string. In the first case the depth was measured from the string to the apex of the truss; in the second, from the same string to the crown of the arch. The next step was to get rid of the tie in the arch by applying at each end an immovable abutment, and then we had in effect just the same beam as at first, with an upper portion, the voussoirs, in compression; an imaginary lower portion, the tie, in tension; and the d^2 preserved by the resistance of the abutments: that is to say, a beam with the superfluities cut out, and the cross strain all converted as in the truss. The history of the arch was then referred to. Although the old Egyptians and Assyrians were said to be ignorant of the arch, they accepted the principle of it, in a certain way, even better than the Romans. What the Romans did was to introduce the use of the arch extensively, by making a characteristic feature of it, and thus it was that the semicircular arch became a matter of every-day construction throughout the world. In the twelfth century a new arch was introduced from the East, viz., the pointed arch, which was stronger than the semicircular arch. The reason for the introduction of this arch might be that the European builders had got into the habit of building less substantially than their predecessors, so that a great many of their buildings gave way. There could be little doubt that the pointed arch was introduced, not for show, but for a sufficient reason, which must have been a question of strength. The lecturer next touched on bridge equilibration, referring to Southwark Bridge as a special example, and finally dealt with flying buttresses. What he had wished to impress upon his hearers throughout the whole was the development of the beam, in the first place, into the truss; and in the second place, into the arch; the strength being identified from the beginning to the end with the d^2, the most important element in the formula of calculation. Whatever might be the form of any construction which had to carry a load from one support to another, it must always be looked at in that light. There was something equivalent to the upper surface or flange of the beam which was in compression, and something equivalent to the lower flange or tie-rod which was in tension, and between these two there was the element of depth. This he termed the comparative anatomy of beams, trusses, and arches, their comparison resulting in a certain identification of philosophical or constructive principle, most important to understand and most interesting to study. The only consideration to be borne in mind was, that whatever forms of construction or contrivance, whatever new, strange, or apparently hazardous forms, were developed or designed, the sectional areas must be adjusted,—that which was in compression being adjusted to that which was in tension, thus giving the full force of the d-square to carry the load. He had thus desired to lay before them, in the first place, an intellectual exercise of a strictly practical and common-sense character, and, in the second place, a proposition full, at all events, of suggestiveness to practical men, and of considerations which might be developed as occasion offered into sound, substantial, and serviceable knowledge.

The lecturer, after complimenting his numerous hearers upon the close attention with which they had followed his discourse, resumed his seat amidst loud applause, and a vote of thanks was passed to him, on the motion of Mr. Kennard, seconded by one of the artisans in the body of the hall.

HOUSE SANITATION.

The second lecture of the course was delivered on Wednesday evening, to a large audience of the artisan class. The lecturer was Professor Corfield, M.A., who treated of "House Sanitation."

Professor Corfield dealt first with permeable and impermeable soils and the diseases attaching to them. To plaster the outside walls of a house was to render it permanently unwholesome, and the way to cure damp was to put a damp-proof course in the walls when the house was built. This course would be of tar, asphalte, or tiles set with cement, or better still of stoneware. This was a matter of the greatest importance, and was the only way of preventing dry rot in timbers. The sub-soil or ground-water varied very much in different localities, and at different times. The nearer this water was to the basement the more unhealthy would the house be, and it had been generally shown that wherever means had been taken to lower the level of the ground water, there the death-rate from consumption had been lessened. Ground air, again, which made its way into the house, contained foul organic matter, and its entrance should be prevented by having an impervious basement floor made of cement concrete, or of York paving set in cement or asphalte. In houses where this precaution had not been taken the inmates were usually unhealthy. The air of over-crowded places contained foul organic matter, with a little less oxygen and a little more carbonic acid than the ordinary air. It was, therefore, of the utmost importance that the air should be changed, each individual requiring about 3,000 cubic feet of air per hour. The wind by perflation and aspiration was an important agent in changing the air in houses. If a hole were made in the wall of a room in which a fire was burning, the outer air would flow in like water; but the incoming air should be given an upward direction in the form of an air fountain, and be thus distributed over the room. A piece of wood placed in front of an inlet ventilator would prevent the air falling down, the opening should be such as to give the air an upward direction, but should not be too near the ceiling. In the case of a door one of the top panels might be cut out, and a kind of hopper fastened to it. The well-known Sheringham valve worked on this principle, although it was movable. Louvres formed good inlets, and Venetian blinds in front of a window made excellent inlet ventilators. There was also the system

known as Tobin's tubes. One objection to all inlet ventilators in towns was that soot and blacks came in with the air, but there were a variety of devices to prevent this. Passing on to the water supply, the Professor pointed out the danger arising from shallow wells in the soil, dealing also with the questions of constant and intermittent services, and the necessity for a thorough periodical cleansing out of cisterns. The waste-pipe of the cistern should always discharge into the open air, and the cistern supplying the drinking water should not connect directly with the water-closet. In regard to the disposal of waste matter, dust-bins built against the walls of houses were very unwholesome. The proper way to collect dust was in movable receptacles, like galvanised iron boxes, which could be lifted by one or two men, and emptied into a cart. In the matter of drainage, the old brick house-drains were very bad, being pervious, and allowing rats to work their way through them. One rat in a house would do an immense amount of mischief. The Professor here exhibited part of the waste-pipe of a sink with a hole about 3 in. long made by a rat. House-drains should be impervious, and made of glazed stoneware or iron pipes, the former being better suited for the purpose. After being laid and properly joined the drains should be tested to see that they were watertight. House-drains should be self-cleansing, and the size generally used should be 6 in., the pipes being laid at a fall of 3 in. or 4 in. in 10 ft. A water-trap of some sort ought to be put on the house-drain before it joined the main sewer. The dip-trap commonly used in brick drains was bad, as it was not self cleansing. The water passing through it could not prevent an accumulation of filth, and it was, in fact, a small cesspool. A much better form of trap was that commonly called a syphon, but which might be termed a U-trap. This was self cleansing, and no deposit would take place if a sufficient amount of water passed through it. In spite of the traps in the drains, a certain amount of foul air would pass through them, and they therefore required to be ventilated. The ventilating pipe carried above the roof was not sufficient; there should be an inlet for fresh air, the trap having a pipe leading up to the level of the ground, with a grating over it. The air would then come in at the inlet, and leave at the outlet, and if it did not do this it was the fault of the arrangement, not of the system. The water-closet should be of as simple a form as possible, one of the best forms being the short hopper or "Artisan's" water-closet, provided with a flushing rim. A basin of this kind with a small bend underneath it, might be perfectly self-cleansing if supplied with sufficient water by means of a 1¼-inch lead pipe. The syphon-action water-waste preventer held about two gallons, and might be filled from the drinking-water cistern. In houses where the water-closet was upstairs the descent-pipe should be outside. It should be made of 7 lb. lead or galvanised cast-iron; if not ventilated the foul air would sometimes eat holes in these pipes. The D-trap was generally used upstairs in houses; it was not a self-cleansing trap, but in course of time became foul. The waste-pipe of the sink should not be connected directly with the drain, and underneath the sink a syphon trap should be fixed to prevent the entry of air fouled by matter adhering to the sides of the pipe. Rain-water pipes also should not connect with the drains, but should discharge into the yard over gullies. The bell-trap was one of the worst possible contrivances; it was not self-cleansing, and when the top was off the foul air could make its way into the house. The trap which should be used in the yard was the syphon gulley. The Professor concluded by remarking that he had said enough to show that the principles of sanitation as applied to houses were exceedingly simple.

The following are the remaining lectures of the series:—On the 25th inst., Professor Church, M.A., will lecture on "Black, White, and Red Lead"; on March 4th, Mr. Blashill, F.R.I.B.A., on "The Shoring of Buildings"; on March 11th, Professor A. B. W. Kennedy, M.Inst.C.E., on "A Piece of Steel"; on March 18th, Professor Bonney, F.R.S., on "Flint"; on March 25th, Mr. J. Slater, B.A., on "Roof Coverings"; and on April 1st, Professor T. R. Smith, F.R.I.B.A. on "Some Celebrated Timber Roofs."

NO. 16, CARLTON HOUSE TERRACE.

VISIT OF THE ARCHITECTURAL ASSOCIATION.

CARLTON House-terrace occupies a part of the site of Carlton House, the exact position of which is the opening between the York Column and the foot of Regent-street. The original Carlton House was built by Henry Boyle, Baron Carlton, on a piece of ground leased to him by Queen Anne in 1709. He died without issue in 1725, and his house and grounds descended to his nephew, Robert Boyle, Lord Burlington, the well-known architectural amateur. When in 1783 the Prince of Wales, afterwards George IV., was allowed a separate establishment, Carlton House was assigned for his residence, and Henry Holland, the architect, was appointed to execute the necessary alterations: he added the chief features of the House,—the Ionic screen and the Corinthian portico. Carlton House was taken down in 1826, and the columns of the portico transferred to the National Gallery. No. 16, Carlton House-terrace is the town residence of Mr. Alfred Morrison, and, by permission of that gentleman, was the place selected for the second afternoon visit this session by the members of the Architectural Association, which took place last Saturday. The members assembled at the house at three p.m., and were headed by Mr. Cole A. Adams, the president, and Mr. H. D. Appleton, hon. secretary, who conducted them through the various rooms and apartments.

This visit was one of much interest to the members of the Association, the object being to study and examine the decorations of the house by the late Mr. Owen Jones; this design being, we believe, one of his latest works, executed and completed just prior to his decease, April 19th, 1874. The designs and drawings for the decorations and furniture of this house had been previously exhibited in the Vienna Exhibition. They have been more than once described and commented on in the pages of the *Builder*, and at the time of the lamented death of Mr. Jones we published a long memoir of him in this journal, and alluded especially to these decorations as among his best works.*

The cabinet inlays, tables, couches, chimney-pieces, chairs, &c., are generally in that semi-Saracenic style which Owen Jones had made his own. They were carried out very ably by Messrs. Jackson & Graham.

The members dispersed soon after four o'clock, having had a most agreeable hour's study of Owen Jones's decorative work.

THE SOUTH WINDOW, WESTMINSTER HALL.

THE large south window of Westminster Hall, which was executed by Messrs. John Hardman & Co. between the years 1847 and 1851, and erected in the year of the Great Exhibition, is now placed in the hands of the same firm, under the First Commissioner of Works, for restoration, since the destructive effects of the explosion of the 24th ult. The window represents the arms of all the kings and queens, and founders of reigning houses of England from some time before the Conquest downwards. Fortunately it has been found that all the authorities and drawings prepared by Messrs. Hardman with much labour and care some thirty-seven years ago, from which the work was executed, are safely preserved in their possession, and will be of course invaluable in the work of restoration.

The window in its present damaged state exhibits a remarkable and interesting evidence of the power of *suction* peculiar to dynamite in explosion. The panels of leaded glass, nearly 100 in number, much torn and distorted by the force of the explosion, are nearly, without exception, bulged *inwards;* the plain diamond-shaped glazing which formed an outer guard or protection to the stained glass, is bulged outwards at every point, but the inner window bears unmistakable evidence of a sudden and violent contraction of air immediately subsequent to the first expansion recorded by the state of the outer glass. It would seem that the same force would account for the fact of the two constables and Mr. Green being found drawn into the hole which the explosion itself had made.

Messrs. John Hardman & Co., who designed and executed all the stained glass in the new Palace of Westminster, under the late Sir Chas. Barry, are commissioned to restore all that is destroyed or damaged, comprising a number of windows in the House of Commons, Division Lobbies, and St. Stephen's Hall. Except to the great south window in Westminster Hall, the greatest damage is to the series of windows in St. Stephen's crypt. The total cost of Messrs. Hardman's restorations will amount to some 2,000*l.*

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* *Builder* (May 9, 1874), p. 385.

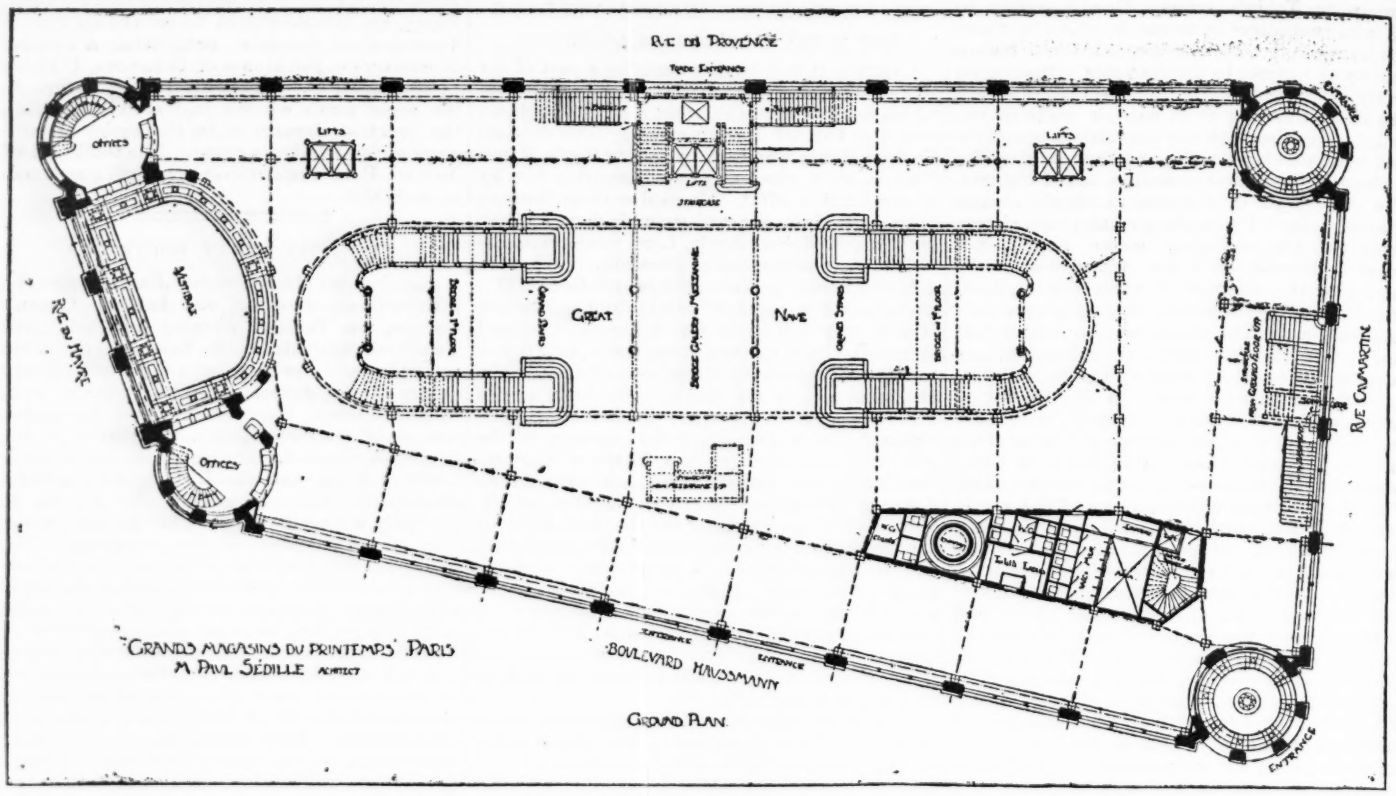
ARCHITECTURAL SOCIETIES.

Birmingham Architectural Association.—The fifth ordinary meeting was held at Queen's College, on Tuesday evening last, when the Vice-President (Mr. W. H. Kendrick) delivered an address. He first of all dealt with the affairs of the Association, and inferred that, judging from the present and increasing success of its classes, &c., prosperity in the future was assured. The connexion now existing between them and the London Architectural Association was commended, as serving to mutually strengthen each other for the promotion of the interests of the profession. The lecturer then gave his views upon the education of architects, and recommended the pupilage system, supplemented by technical study, as by this method the vigorous individuality of British design would be sustained. He desired also a greater appreciation of art workmen, and as a means for their improvement he desired the establishment of a technical museum in Birmingham. This should contain a competently arranged collection of specimens of every period of architecture and sculpture. He believed that if this were accomplished the art work of the town would be raised in tone, and the workman, by the study of good examples, would be dissatisfied with his present meaningless productions. On the proposition of Mr. H. H. McConnal, supported by Messrs. R. B. Morgan and Victor Scruton (hon. sec.), a hearty vote of thanks was accorded to the lecturer.

Architectural Section of the Glasgow Philosophical Society.—On Monday evening last a meeting of the members of the Architectural Section of the Glasgow Philosophical Society was held in their Hall, 207, Bath-street. Mr. Landless, architect, presided. Mr. R. A. M'Gilvray read a paper on "Plaster Work." He confined himself to the plain branches, and said he hoped at some future time to say something of the ornamental branches. Mr. Henry Morrison subsequently read a paper on "Slates." He traced the growth of slate rock, and pointed out the localities of the principal slate ranges in this country. He also referred to some of the more important slate quarries, to slates as a covering for roofs and as articles of commerce.

British Museum Lectures.—On Wednesday next Mr. W. St. Chad Boscawen will commence a second series of six afternoon lectures on the "History and Antiquities of the Assyrian and Babylonian Empires." The unexpected success which attended the former course has enabled the authorities of the British Museum to arrange a new and commodious lecture-room in the new east wing of the Museum, where the lectures will be given each Wednesday at 2.30. The subjects selected for the present course are, February 25th: "The Chaldean Temple: its Construction, Symbolism, and Services"; March 4th, "The Creation Legends"; March 11th, "The Palace: its Architecture and Ornament"; March 18th, "The Deluge Legend"; March 25th, "Chaldean and Assyrian Libraries"; April 1st, "The Legends of the War in Heaven." The lectures will be fully illustrated by maps, plans, and diagrams, and casts of antiquities from other museums. In order that students attending the course may become familiar with the monuments in the British Museum, Mr. Boscawen has arranged a series of morning tours of demonstration, to which the lecture-tickets will admit. Tickets and full syllabus of the lectures may be obtained from Mr. W. B. Cutter, 36, Great Russell-street, Bloomsbury, W.C.; or on application by letter to Mr. W. Boscawen, at the British Museum.

International Inventions Exhibition.—We understand that the Wilkes' Metallic Flooring Company, of 17, Devonshire-square, Bishopsgate, have received instructions to pave the Old London Street at the International Inventions Exhibition.



Illustrations.

THE "MAGASINS DU PRINTEMPS," PARIS.

THE vast "Magasins du Printemps," of which two-thirds only are reconstruction, occupy, including the new building and the rebuilt portions, the large trapezium-shaped site bounded by the Rue du Havre, the Boulevard Haussmann, the Rue Neuve des Mathurins, and the Rue de Provence, between the new Opera and St. Lazare Railway Station. These buildings are noteworthy as much for their internal arrangements as for their external architecture; and their architect, M. Paul Sédille, has distinguished himself in the threefold capacity of engineer, architect, and decorative artist. It may be added that the company, of which M. Jaluzot is the director, has placed immense sums at his disposal, both to insure the solidity of the foundations (which are partly laid across or in a subterranean pool of water), to give full scope for costly decoration, architectural and sculptural, and to bring the latest mechanical improvements to bear on the full ventilation, warming, and lighting of this vast hall of stone, iron, and glass.

Our illustration of the building, which is engraved by Mr. Cooper from a photograph, shows only the principal and most ornate front; the long flank of the building, of which a small portion only is seen in the view, is a good deal shut in by trees, and is more utilitarian in character.

SCULPTURE.

We give separate illustrations, to a large scale, of the principal sculptures, representing the Four Seasons, by M. Chapu, which are in themselves fine works of art. In England we see decorative architectural sculpture of this class, even on a large scale, so frequently given over to mere carvers, and marked by nothing better than respectable mediocrity, that it is desirable to emphasise the fact that, in some cases at all events, they "manage these matters better in France." Why are not our sculptors given similar opportunities?

HÔTEL BOURGTHÉROULDE, ROUEN.

THIS extremely interesting building may be easily overlooked. It is reached through a low archway leading from the Place de la Pucelle. The façade, of which our illustration shows one bay, forms one side of a courtyard. An adjoining side is of late Gothic work, and is well illustrated in Pugin's work on Normandy. The remaining sides are mostly modern, and of little interest. G. G. WOODWARD.

A BIT OF OLD FRENCH RENAISSANCE.

THE sketch of a portion of the Francis I. part of the Château of Blois is reproduced, from a sepia sketch by Mr. A. B. Pite, by Messrs. Boussod & Valadon. It was originally made to afford a sample of this method of reproduction through the agency of photography, of which another example was given in the first number of the *Builder* of this year (Callender House).

The process, which results in what is practically an engraving on metal in very low relief, is satisfactory as a reproduction of monochrome brush drawing, and can be used in any other cases where contributors prefer it to other processes. In the case of coloured drawings it is open only to the objection which affects all photographic reproductions from colour,—the balance of light and dark is not preserved in the case of certain colours.

The bit of architecture represented exhibits well the admirable qualities of that school of French Renaissance, forcible yet refined, which Viollet-le-Duc characterises as the best modern application of Classical materials in architecture. A great deal of Mediæval feeling still pervades this type of French Renaissance.

OBITUARY.

Mr. John Middleton, F.R.I.B.A., of Cheltenham, died on the 13th inst., at Adpar House, Newcastle Emlyn. He was elected a Fellow of the Institute in 1876. At the meeting of the Institute on Monday evening last, Mr. Alexander Payne said that Mr. Middleton had been in business as an architect for at least thirty years. He practised successfully at Darlington, then spent some years in travelling, especially in Italy, and finally settled in Cheltenham, though without the intention of practising there. A year or two afterwards, however, he gratuitously made the design for All Saints Church, Cheltenham, which was so much admired that he was induced to commence practice again, and carried out the Ladies' College, Cheltenham, and a great many other works in the neighbourhood, having especially a large connexion amongst the clergy in Wales. Whilst on a business round, through Wales, a week ago, Mr. Middleton was struck down by paralysis. He was devoted to his profession, and several well-known men were brought forward by him, amongst others Mr. Boulton, the architectural sculptor.

Mr. Colin Minton Campbell, of Stoke-on-Trent, died on the 8th inst. He was the grandson of the founder of the extensive china works at Stoke, which were commenced in 1788. He was born in 1827, and at the early age of fifteen years he was inducted into the pottery business by his uncle, Mr. Herbert Minton, who, having no children of his own, seems to have taken a special interest in his nephews. Under his watchful supervision, Mr. Campbell became a good practical potter, and was also made acquainted with the commercial department of the business. Upon attaining his majority Mr. Campbell was taken into partnership with his uncle.

THE DRAINAGE OF GREATER LONDON.

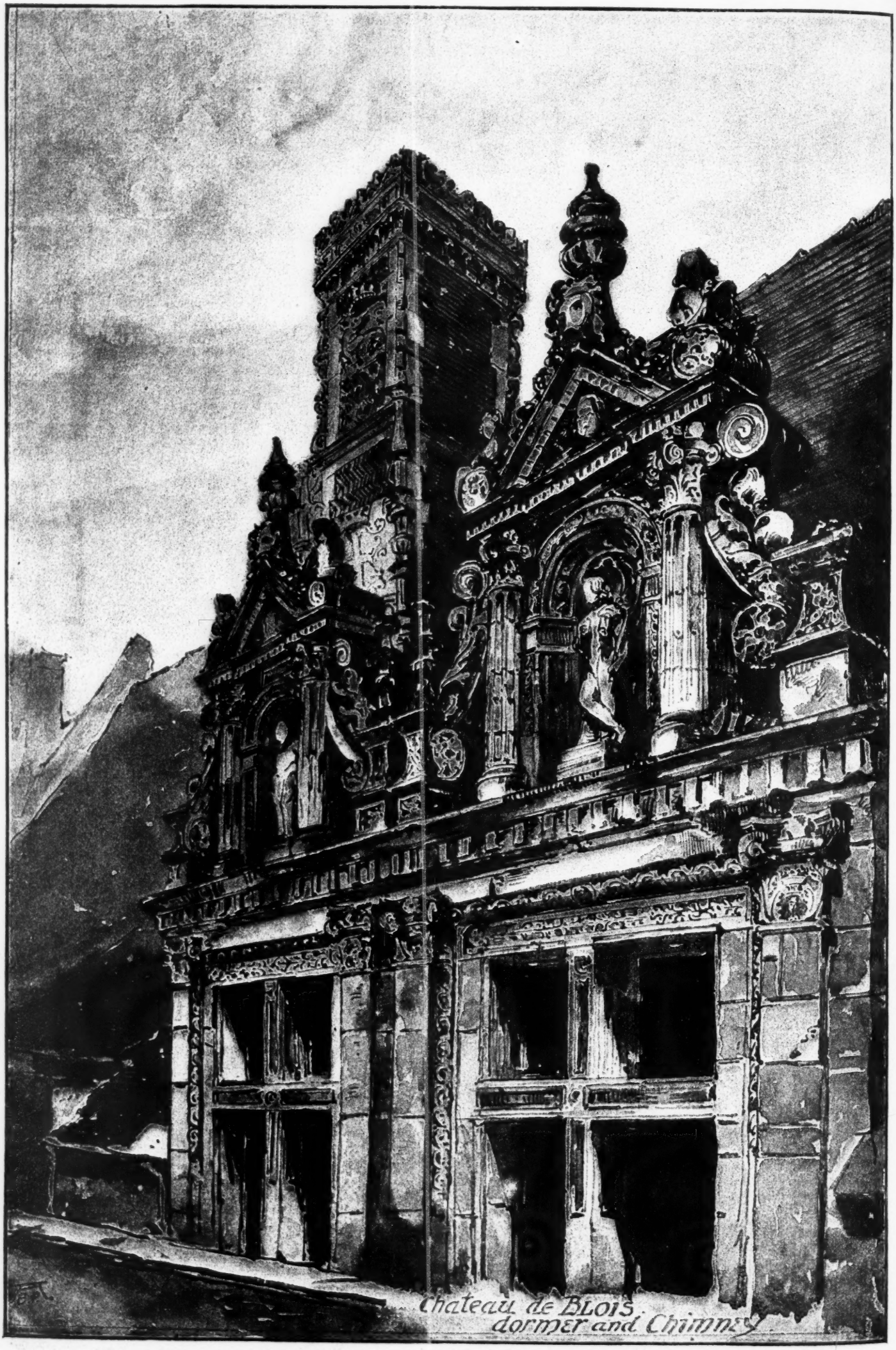
AN important report was to be presented to the Metropolitan Board of Works at its meeting yesterday (Friday), by the Works and General Purposes Committee, who recommend,—

"That, in reply to their communications, the Home Secretary and the Local Government Board be informed that this Board has had under consideration the suggestion that the parish of Tottenham should be annexed to the metropolis, pursuant to section 249 of the 18 & 19 Vict., c. 120, especially with reference to the main-drainage system, but that the Board is advised that financial and other arrangements would be involved in such a proceeding to which legal effect could only be given by special legislation, and that, in considering the question of the drainage of Tottenham, it would further be necessary to have regard to the possible expediency of taking the sewage from other localities in the Valley of the Lee, which could not, as the Board is advised, be dealt with under the 249th section.

That, even if it could be so dealt with, there would still remain the question whether it would be expedient to deal with that portion of the outlying districts of the metropolis otherwise than as part of a measure for the general extension of the drainage to the whole of the districts round London.

That, at the same time, should her Majesty's Government decide to promote legislation with a view to bring outlying districts within the metropolitan area,—which measure would, however, as above mentioned, necessitate the consideration of very important financial and other matters,—the Board would not be unwilling to have the duty cast upon it of dealing with the sewage of the lower valley of the Lee, as well as that of other outlying districts."

New Buildings at Westminster Workhouse.—For some time past the Guardians of the Westminster Union have been alive to the fact that the accommodation for pauper lunatics of the male sex has been very inadequate, and the result was an application to the Local Government Board for permission to erect a building affording the requisite accommodation. That permission having been obtained, the plan of Messrs. Saxon Snell & Son, of Southampton-buildings, was decided upon, and the contract for the execution of the works has just been entrusted to Messrs. Mowlem, Burt, & Freeman. The building will be erected within the precincts of the workhouse in Poland-street, and will occupy part of the space which is at present an open quadrangle bounded by the workhouse buildings. The structure, which is intended for the accommodation of about a dozen patients, will be one story high.



A BIT OF OLD FRENCH RENAISSANCE.

HOTEL · BOURGTHEROULDE · AT · ROUEN ·

PORTION · OF · FACADE · ON · SOUTH · SIDE · OF · COURT-YARD ·

Cornice · at · A

Neck.g B

Ornament · on · Arch-mould · K

There are Six Bays to this Façade of which this is the third counting from the left.
The carved ornament differs in each Bay, and the panels at top and bottom of same are in Mezzo Relievo illustrative of the meeting of ~~Henry VIII and Francis~~ I. at the Field of the cloth of gold.

String · at · C

Necks D

Base at L

E

F

The top is now covered with a modern roof and the window openings filled with modern casements.

Carved · Panel · here

G

H

I

Sill · at · E

FRONT · ELEVATION ·

SECTION

SCALE · OF · FEET

Necking · at · F

String at G

Base · to Pilasters

Sill

Lower Plinth · at · I

Upper · Plinth at · H

PLAN ·

Bases here, but doubtful so omitted.

Note. All Mouldings were taken Full Size on the spot and are here carefully reduced to Half Full Size.

Ornamented Mouldings were sketched Full Size and all ornament to Inch or Two Inch Scale on the spot.

This Moulding was not taken Full Size but carefully measured.

Arch-mould · K ·

George Gilbert Woodward.

Measured July

Drawn. September 1882 ·

C. F. Kell, Photo-Lith. & Printer.

8, Castle St. Holborn, London, E.C.

INK PHOTO. SPRAGUE & Cº. LONDON.

SCULPTURE, MAGASINS DU PRINTEMPS.

"L'AUTOMNE."

M. CHAPU, SCULPTOR.

"INK-PHOTO" SPRAGUE & Cº. LONDON.

SCULPTURE, MAGASINS DU PRINTEMPS.

"LE PRINTEMPS."

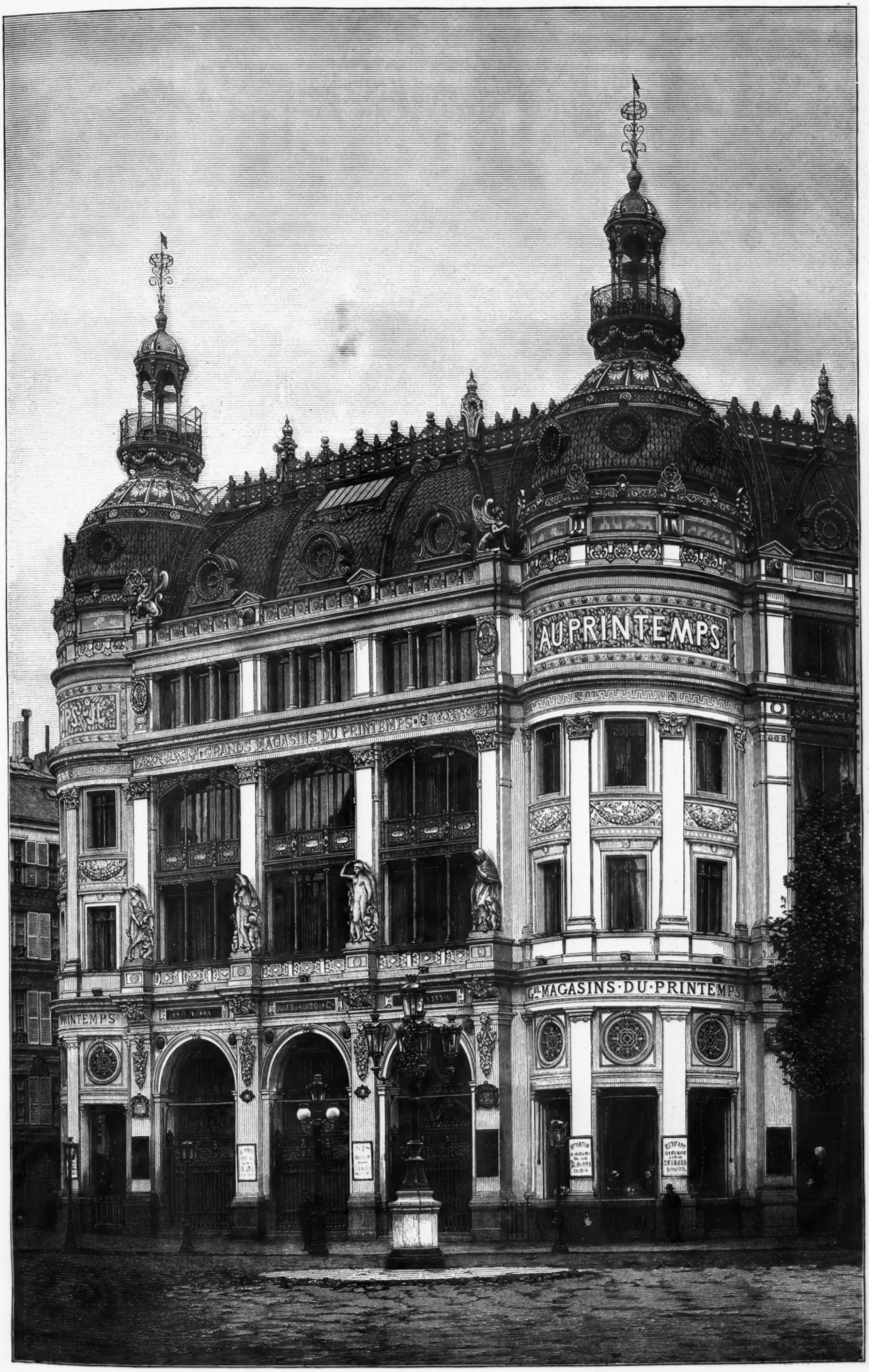
M. CHAPU, SCULPTOR.

"INK-PHOTO", SPRAGUE & Cº, LONDON.

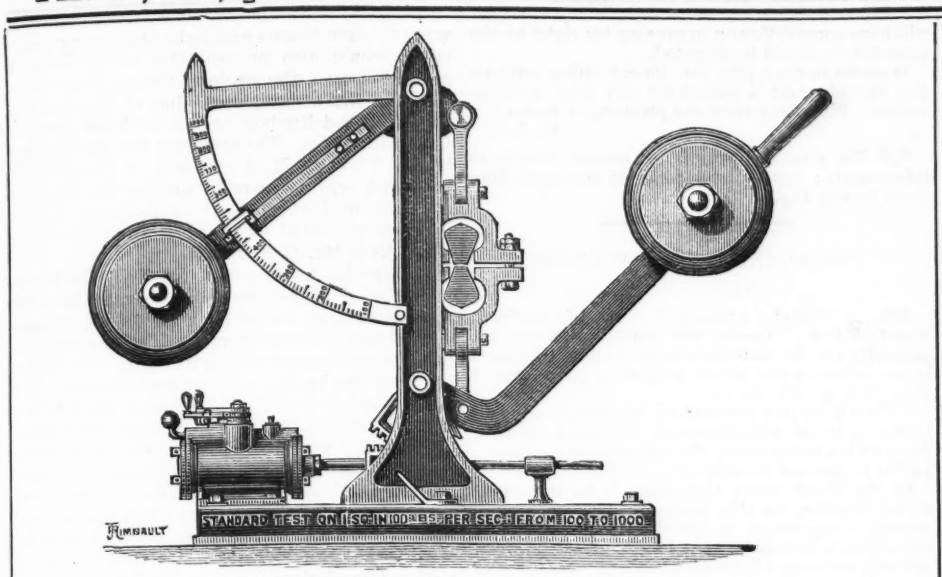
SCULPTURE, MAGASINS DU PRINTEMPS.
"L'ÉTÉ."
M. CHAPU, SCULPTOR.

"INK-PHOTO" SPRAGUE & Cº. LONDON

SCULPTURE, MAGASINS DU PRINTEMPS.
"L'HIVER."
M. CHAPU, SCULPTOR.



THE "MAGASINS DU PRINTEMPS," PARIS.—M. Paul Sédille, Architect.



Michele's Automatic Cement-Testing Machine.

MICHELE'S PATENT AUTOMATIC CEMENT-TESTING MACHINE.

WE illustrate above a new and improved machine for testing cement, lately patented and brought out by Mr. V. De Michele, of 14, Delahay-street, Westminster. As will be seen, it differs considerably from the machine which has been hitherto associated with his name, and which has been so extensively adopted by the principal cement manufacturers and users for many years past.

The old machine is so well known as hardly to need description here, but we may remind our readers that the cement briquette was broken by exerting a pull through the briquette on the short end of a weighted lever, by means of a handle and worm, and wheel.

In the new machine, as will be seen by our illustration, the strain is applied by the weighted lever on the right-hand side of the machine falling, and as it does so, raising through the medium of the briquette, the other weighted lever, the motion being governed by a handle regulating the resistance of oil to the piston of a cataract. In this way the motion of the machine is most completely under control, and is, moreover, very uniform and steady. The handle can be set so as to break a briquette as slowly or as quickly as may be desired, but the standard test is that the strain should be applied at the rate of 100 lb. per second on the square inch. At any period of the stroke the machine can be stopped for any desired interval, and when re-started, applies the strain at the same rate as it did before the stop. The machine is also made in a non-automatic form. In this case the weighted levers are in equilibrium at all portions of the stroke, and the briquette is broken by lowering the right-hand lever by hand pressure.

The Strains on the Forth Bridge.—At a meeting of the Royal Scottish Society of Arts, held last week, Dr. Edward Sang read the second part of his paper giving "An Elementary View of the Strains on the Forth Bridge due to the Shifting Load." This part of the paper was devoted to the geometry of the cantilever truss, and in the course of his remarks Dr. Sang traced the laws of trussed structures and the method of lessening strains, and referred to the stiffness of the structure in question, and the determination of the distance between the piers. Regarding the structure of the truss, he said he was at variance with the designer of the bridge, The crossed bracings introduced new points, each of which must have its three determinants; but as the bracings were in pairs, and as no collection of even numbers could ever make an odd number, there must always be either deficiency or redundancy. Solely from a geometer's point of view, the construction was inadmissible. Mr. Westland said no one could say anything against what Dr. Sang had said. His theory was perfectly correct, and he must say that the double bracing of the pier was just the one fault he could see with design of the bridge. Mr. Reid said that, after the experience of the Tay Bridge, he would be inclined to doubt some of the calculations of some of the people who had to do with the Forth Bridge.

ROYAL ARCHITECTURAL MUSEUM AND SCHOOL OF ART.

PRIZE DISTRIBUTION.

ON Monday evening last, Mr. P. R. Morris, A.R.A., presided at the annual distribution of prizes to the students of the Art School at this Museum, situate in Tufton-street, Westminster.

The curator, Mr. Randall Druce, presented a report which stated that the school had earned last year a Government grant of nearly 100*l.*, the highest yet gained. The Saturday "Life Class" numbered 36 students, with frequently 20 in attendance; while the evening class for drawing from the life, though only started last March, had outgrown the accommodation provided for it. The class for Modelling in Clay numbered about 12, and that for Drawing from the Antique 42 students. The Elementary Class had 60 members. Lectures on Architecture, and on Design and Building Construction, had also been given during the year, the exceedingly valuable collections stored in the Museum being thus well utilised. Among the principal prize-winners was Mr. G. Wilson, who gained the silver medal and first prize offered by the Plasterers' Company for a design in mastic for a panel. For Building Construction first-class certificates were gained by Messrs. T. Morgan, J. Jackson, W. King, and E. Bird; and in the Class for Architecture prizes were gained by Mr. Ernest Poole for a design for a cathedral, and by Mr. W. Ferguson. The attendance prize given by the President, Mr. A. J. B. Beresford-Hope, M.P., was won by Mr. W. Kirk.

Mr. Morris having distributed the prizes, delivered an address, in which he observed that the training of the artist must be thorough, and not a training in one branch or speciality of art only, but a training on a very much broader basis. The professor of the pictorial art should know something of architecture, the architect should know something of modelling, and the sculptor should be able to paint. Without such a varied training, it was useless for the artist to think of achieving success in life. Prettiness was the besetting sin of modern art. The sculptor's whole endeavour was too often not to produce a good work, but to make it pretty; but he was, perhaps, not altogether to be blamed,—he only produced what was demanded. Though England was a century later than Continental countries in beginning to recognise the national importance of artistic knowledge, it had a great future before it. We had been too long the Cheap Jacks of the world, but there were signs that the artistic education being given to so many hundreds of thousands of students in our art-schools throughout the country would yet acquire for us a foremost reputation for artistic superiority. Already he had been informed we had obtained a leading position in the export of wall-papers through the superiority of our designs. He looked forward to the time when every man, woman, and child in the kingdom would feel something of that great art-movement and benefit by the influence of such schools as that. We should raise up a race of architects who would rescue our towns and villages from the squalor which seemed to be inevitable at the present day. To drive through London from St. Pancras to Charing-cross and to see the black houses weeping with soot was most depressing. The taste of the rich required to be educated quite as much as that of the poor. In proof of this he had only to call attention to the mania for chocolate colour. Chocolate as a colour did not exist, except in chocolate; and even if it were a colour it was worse than all others for this London of ours. It was a horrible invention. The inventor of chocolate and the inventor of stone colour should have niches all to themselves in the Aquarium.

The Charity and Endowed Schools Commissioners of England and Wales have appointed Mr. Joseph Clarke, F.S.A., their architect.

"WHO WRITES THE SPECIFICATIONS?"

SIR,—If you will permit me to offer a word of comment on your editorial note [p. 225] on my letter [p. 250] in your issue of the 14th inst., I would say that I have always considered a proper specification to be a work that gives ample exercise both to the inventive and to the imaginative faculties. One describes much of one's design that one cannot well draw. One describes ways of doing things, not necessarily routine ways, helping out one's words by abundant marginal sketches. I contend that a specification that can be at all correctly described as "a piece of dry business routine" * signally fails in its scope and purpose. It would be possible to make such numerous drawings, so covered with descriptive notes and memoranda, as would to a great extent supersede such a specification as I speak of. But then this is merely putting part of one's specification on drawing-paper instead of on specification paper. It does not affect my argument. You do not want invention and imagination in quantity-taking. You want a man to measure off accurately, and with knowledge of trade technicalities, what an architect shows on his drawings and describes in his specification. The qualities that would make a man a good quantity-taker are very different from those required in writing a good specification. There are dry technicalities and routine in a set of artistic drawings, as there are in a specification; but a good specification is an interesting document on the whole, and will be read with real interest by the intelligent client. I know accomplished quantity-takers, but I do not happen to know one who is also a good specification-writer. A quantity-taker has to deal with facts presented to, and prepared for, him. An architect (one after my heart) delights as much in his specification as in his drawings, all being a portion of his one design. An architect who does not write, or have written under his own direction, his specifications, is apt to be the kind of man (whom I have known in the flesh too often) who "leaves all that sort of thing to the builder," or, it may be, to the clerk of works. A quantity-taker may write the specification to oblige the architect who finds him work; but he does not, and cannot, write it as the author of the design should do it. It is one thing to depute work to the man who can do it better than one's self, but quite another to shirk one's own proper work that one ought to be able to do better than any one else. EXCELSIOR.

FARM BUILDINGS.

SIR,—Will you permit one who has had some experience in farm buildings, and who looks at the question of designing them from a different standpoint to that generally adopted by architects, to make a few observations *re* Mr. Young's paper and plans as given in the *Builder* of the 14th inst.? Principally, I find fault with him for evidently looking at the question as though, while it is important that they serve their purpose as farm buildings, it is more important that, in their elevation, they shall show that an "architect" had a hand in it. Now, although in the designing of most buildings, whether public or private, questions of style, precedent, taste, &c., are of some importance, they need scarcely at all be considered when planning farm buildings,—not, in fact, to any greater extent than would be required say in designing a set of ironworks. And, if in designing the furnace he were to be influenced in his ideas of proportion (say) by his previous studies of public buildings or private dwellings, instead of by the question of how to make or smelt the iron at the least expense, it would be rather unfortunate for the owner of the works, particularly if he had to meet with much competition. Now this is something like what happens when an architect is asked to design a set of farm buildings. He does not look upon it as a question of how to manufacture meat, or milk, or corn at the most profit,—or perhaps I might say at the least loss,—but how to make a set of buildings that, while they shall in some measure answer the purpose for which they were intended, they at the same time *must* exhibit in the elevations something that, for want of a better name, I will call style, but which in substance is something no more connected with, or necessary for, the manufacture of meat, &c.,

* We did not call it so; we only said that some other people might.—ED.

than it would be for any other business quite foreign to that in hand. And as in the supposed case of building an iron furnace, any other consideration than that of how to make iron in the cheapest and best manner would, if indulged in, be at the cost of the iron made, so similar indulgences in the designing of farm buildings will be at the cost of the articles manufactured in them, and the early probability of "the works being shut up," *i.e.*, the farm being uncultivated.

A detail in Mr. Young's plans which I think is open to improvement, is the unnecessary high pitch and consequent expense of the roofing. I presume they are of tiles, and, if so, I should only have had the roofing of a square pitch, which is ample. Not only is money wasted in this, but the factory is less suited for the manufacture of its goods. Cattle-sheds should be warm, and, for this purpose, should be kept as low as possible. High roofs do not favour warmth. If a desire or study for appearance has prompted these high roofs, a satisfactory result might have been better attained by overhanging the eaves and gables, which would also have protected the walls very much from the rain.

I should have liked to have made a remark or two on some other details, but my main object has been to enter a strong protest against the designing of these buildings being entered upon in any other spirit than that which should actuate a man when designing, say, a furnace for smelting iron or a steam saw for sawing wood.

It is probably news to most members of the profession that it is in consequence largely of this adherence to details suitable only for very different buildings, combined with a want of knowledge of the requirements of farm-buildings, they are so little employed in this branch. To those who do make it a study it is an unworked and profitable mine. H. G.

THE ROYAL ARMS.

SIR,—"J. B.," in your issue of the 31st of January [p. 182], referring to my letter of the preceding week [p. 152], as to the place of honour as supporter being held on the Scottish shield by the unicorn instead of the lion, asks if I can tell whether the quarterings on the shield are also reversed in Scotland.

This point I could not answer of my own knowledge, so I wrote to a friend in Edinburgh who was likely to be able to give the information, which he supplies quite to the point in the following words:—

"You are quite right in your heraldry of the royal arms of Scotland. If you consult Chambers's 'Encyclopædia,' under the head of 'Scotland, Royal Arms,' you will find a short account of the matter. The arms of the two countries came to be quartered at the time of the union of the crowns in 1603, and since then *in Scotland* precedence has always been given, not only to the unicorn, &c., as supporter, but to the Scottish lion on the quarterings occupying the first and fourth quarters, while England and Ireland hold the second and third quarters respectively; on all judicial seals and public buildings in Scotland the rule prevails. The Act and Treaty of Union, sec. 24, sanctions the ancient Scottish seals. The question of the proper marshalling of the Royal arms within Scotland was raised in 1853 by a petition to the Queen from the magistrates of Brechin: a reference was made by the Home Office to Garter King of Arms, and to the Lord Lyon, who considered Scotland entitled to precedence on the judicial seals of the country, and his views have since continued to be acted on."

EDWD. COCKBURN.

CLOSET AND DUST-BIN.

SIR,—Allow me to call the attention of architects and others interested in sanitary matters to the description of a "recent patent," which appeared in your issue of the 24th ult. [p. 153], the one numbered 13,841, entitled a "Closet and Dust-bin" combined, by J. Ennals. I maintain there is nothing new in his arrangement, substantially the same thing having been in use for years. Attached to my house is one where a modification (I might say a great improvement) of the same idea is in use. Instead of the moisture being encouraged to draw to the front, and become mixed with the soil and dust, and so become a great nuisance (it is generally admitted that the nuisance of ordinary privies lies in the collection and retention of moisture), it is drawn to the back of the receptacle and drained off, and connected with a sewer, leaving the *rest* of the "contents innocuous." I am afraid under Mr. Ennals's arrangement it would hardly be so, owing to its being so sloppy, and more readily giving off an offensive odour.

I think under these circumstances, Mr. Ennals will have some difficulty in proving his right to the patent if it should be disputed.

It seems to me a pity the Patent Office authorities should grant a patent for any such arrangements. Why not patent the planning of rooms?

W. J. S.

*** We give the patents, of course, simply as information; not as endorsing or recommending them in any way.

"NON-ACCEPTANCE OF LOWEST TENDER."

SIR,—I shall be obliged if "Mr. W. Hoffman Wood, F.G.S.," Leeds, will kindly give me his authority for the statement he so confidently makes in his letter on the above subject in your issue of Feb. 14th, p. 252, viz:—

"That if he [the contractor] has simply applied, in answer to an advertisement, for the quantities, &c. (and his tender being the lowest is not accepted), he has no ground for action."

Is Mr. Wood aware that there is an important action pending, on this particular point, against a wealthy Corporation in the West? The result of this action is looked forward to with great interest, and will seriously affect every responsible contractor in the kingdom who devotes his energies, experience, and valuable time to the preparation of *bonâ-fide* tenders for the execution of works or the supply of goods.

I should like Mr. Wood to say what is the object of advertising for tenders, unless it is to obtain the lowest possible estimate from a substantial contractor.

BONA FIDES.

GREY FRIARS CHURCH, ABERDEEN.

SIR,—The authorities of Marischal College, Aberdeen, contemplate an extension of their buildings, and it is rumoured that in the event of the scheme being carried out they seriously propose removing the old Grey Friars Church which stands on the site; but as this fine old building can easily be converted into a College Hall there is no justification whatever for such an act of Vandalism. It will be a source of lasting regret if anything of the sort takes place.

G. S. A.

STOCKHOLM TAR.

SIR,—Last summer I had the weather-boarding of some new farm buildings tarred with two coats of Stockholm tar, which, after about a month or so, became the colour of mud. Could any reader tell me the cause of this? Soon after the tar had been put on we had some very wet weather, and I also find now that the men used paraffin with the tar to make it work on easy. Would this cause it?

E. B.

PROVINCIAL NEWS.

Chester.—The foundation-stone of the new Museum and School of Art for Chester was laid a few days ago. The style of the building is an adaptation of the Anglicised Renaissance which was in vogue during the seventeenth century. The accommodation for the various purposes is comprised on three floors, besides a basement, which would be available for stores, &c. The ground-floor is about 4 ft. above the level of Grosvenor-street, the main entrance being through a corridor leading to a large open staircase-hall, whence access is gained to each department. On entering the building there is a joint library and reading-room, 21 ft. by 19 ft., on the left, and an apartment on the right, 36 ft. by 25 ft., intended as a natural history museum; beyond this is the lecture-theatre, 44 ft. 6in. by 30 ft., having two distinct entrances from the staircase-halls, beside platform-entrance and preparation-room at the other end: this room is specially arranged so that all present may have an uninterrupted view of the platform and the lecturer's table, and, in connexion with the preparation-room, a lift is provided to the chemical laboratory on the first floor. The room to be devoted to the archæological specimens, and also to an art-gallery, is 60 ft. by 25 ft., with top light suitable for pictures, &c. The first floor comprises joint committee-rooms 20 ft. by 19 ft., two science-class rooms having an area of 1,170 square feet, and a chemical laboratory 30 ft. wide, having an area of 520 square feet, and there is a room devoted to the school of art on this floor 320 ft. in area. The second floor is devoted entirely to the school of art, being upwards of 66 ft. in length and 25 ft. 6 in. in width, amply lighted from the northwards; besides this there is a master's room 14 ft. 6 in. by 12 ft., so situated as to overlook the whole of the teaching space. The whole of the floors of the main building will be fireproof, with wrought-iron beams and light Dennett arching, which would also prevent the transmission of sound between the various floors. The materials for the decorative facing of the exterior consist of red Ruabon bricks, with dressings of Grinshill stone. The architect for the building is Mr. Thomas M. Lockwood, of Chester, and the work will be carried out by Mr. Edmund Gabbutt, of Liverpool, whose tender of 8,150*l.* has been accepted by the committee; the clerk of works is Mr. E. Muspratt.

Liverpool.—Some eight years ago the Liverpool Union Bank opened a branch in Bold-street, and they have now removed the business to new and spacious premises in the same street, which were opened on the 9th inst. The building is of the Italian style of architecture. The lower portion is of polished Scotch granite, and the entrance to the bank is of stone surmounted by a carved representation of the arms of the bank. There is an outer and an inner vestibule, and the bank proper is situated in the centre of the building. It is one story high, apsidal, and is lighted by a cupola and other lights high up next to the ceiling, all of which are filled in with coloured glass. The walls of the vestibules are lined with marble and faïence glazed tiles, and the floors are covered with mosaic. The fittings throughout, door casings, &c., are also of American walnut, and the counters are made of the same wood. There is a keeper's residence at the back, and the front portion over the shops adjoining the bank is to be used as showrooms and workrooms. The cost of the new building is about 9,000*l.* The granite has been supplied by Messrs. Newall, of Dalbeattie; the decorative and tile work by Messrs. Simpson & Son, of London; Messrs. Jones & Sons, of Pleasant-street, Liverpool, were the contractors, and the architect is Mr. G. E. Grayson, of James-street.

Rotherham.—At a Council meeting of the Rotherham Corporation, held last week, Mr. H. L. Tacon, of Rotherham, was appointed architect for the proposed new baths and free library, which are to be erected at a cost of 6,000*l.*

Richmond (Yorkshire).—At the meeting of the Richmond (Yorkshire) Town Council held on the 4th inst., it was decided to proceed with the New Cemetery, and Messrs. Clark & Moscrop, architects, of Darlington, have been instructed to prepare plans for laying out the ground and for the erection of chapel and lodge.

Darlington.—On the 6th inst. the new Hospital and Dispensary at Darlington was formally opened by Mr. J. B. Hodgkin, the Mayor, on which occasion his worship was presented with a silver key by the architect, Mr. G. G. Hoskins, F.R.I.B.A. The key, which has been specially designed by the architect, and manufactured at his expense by Messrs. Harrison & Son, silversmiths, Darlington, is of solid sterling silver, weighing 4 ounces. The several contractors have been:—For excavating, brickwork, and mason's work, Messrs. J. W. & M. McKenzie, Darlington; carpenter and joiner's work, Mr. R. T. Snaith, Darlington; plasterer's work, Mr. R. M. Ormerod, Carlisle; slating, Messrs. G. Pattison & Son, Darlington; plumber and glazier's work, Mr. Emmerson Smith, Darlington; and painting, Mr. John Law, Darlington. The heating arrangements are by Messrs. Haden & Son, of Manchester. Mr. Joseph Hindmarch was the clerk of the works.

Colchester.—The Board of Guardians have decided to appoint Mr. J. W. Start, architect (of Colchester), to inspect the tramps' ward and make suggestions as to structural alterations for the better accommodation of vagrants.

Torquay.—The construction of a new reservoir, filter beds, &c., in connexion with the above works has been carried out to meet increasing requirements. They are situate at Kennick, near Christow, Devon, in close proximity to the company's existing reservoir at Tottiford. The first sod was cut some two years since, but on account of the fissures in rock, &c., that have been met with, the works have been carried out under very great engineering difficulties. They are now completed, and Torquay will have a plentiful supply of water for the future. The two reservoirs have a superficial area of a hundred acres, and are capable of containing 300,000,000 gallons of water when full, or a supply for 300 days for the whole of the district supplied. The engineer is Mr. H. M. Brunel, of Delahay-street, Westminster, and the works have been carried out by Mr. A. Krauss, of Bristol.

The Student's Column.

DESCRIPTIVE GEOMETRY. — III.

THE second method of solving problems is by *changes of projection planes.* This means, an object being drawn on given planes of elevation and plan, redraw the object on other planes of elevation and plan which suit your purpose better. For instance, a bow-window being drawn in your general elevation, if you want to show exactly the sides of the bow-window, you must make a special elevation of the side on an *elevation plane* parallel to that side. This is quite elementary, but there are numerous cases where the process is not so obvious, such as, for instance, as: find the exact shape of the sides of an octagonal roof over a bow-window.

PROBLEMS ON PLANES.

If a plane P be given by its traces P^h and P^v, as in accompanying figs. 11 and 12, any line, A, belonging to the plane P will, if prolonged, intersect the picture planes in points *m* and *n* on the traces P^h and P^v of the plane P.

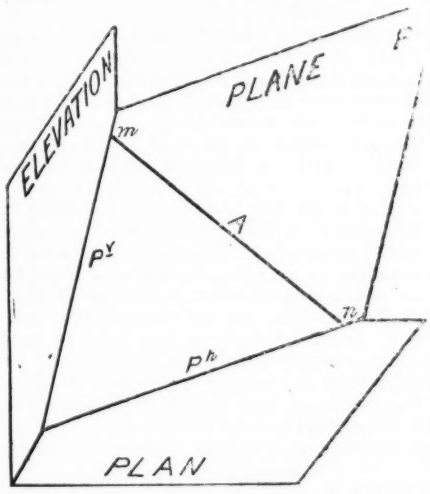


Fig. 11.—*View of Plane* P, *and its Traces,* P^h P^v.

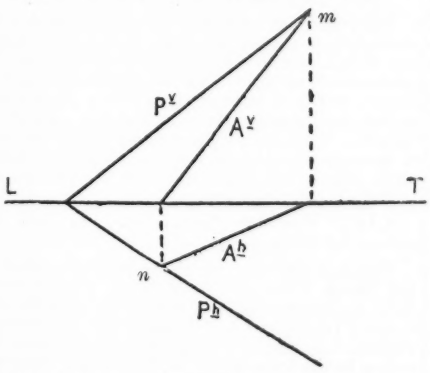


Fig. 12.—*Geometrical Representation of the above.*

The slope of the plane P is given by a straight line, A, thereof, perpendicular to the horizontal trace P^h of that plane, as in fig. 13.

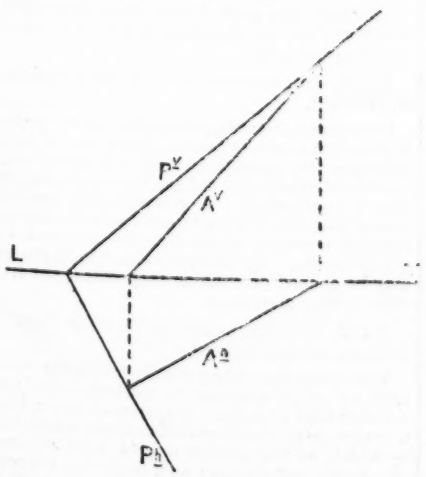


Fig. 13.

The inclination of line A is to be found by rotation as shown before. The slope of a roof will be given by a line perpendicular to the eaves.

Any horizontal line A belonging to a plane P will be parallel to its horizontal trace P^h (in a roof to its eaves). If a point belongs to a plane it will be on a line belonging to the same plane; as the point *m* in fig. 14.

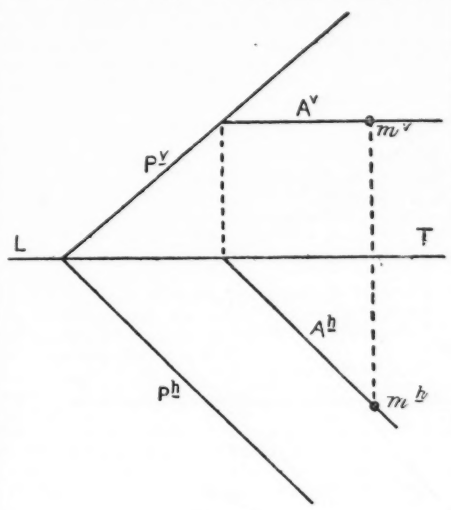


Fig. 14.

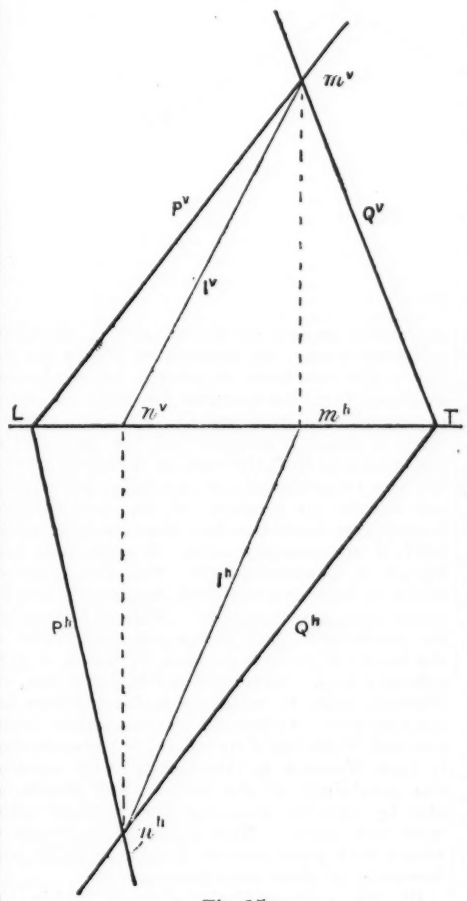


Fig. 15.

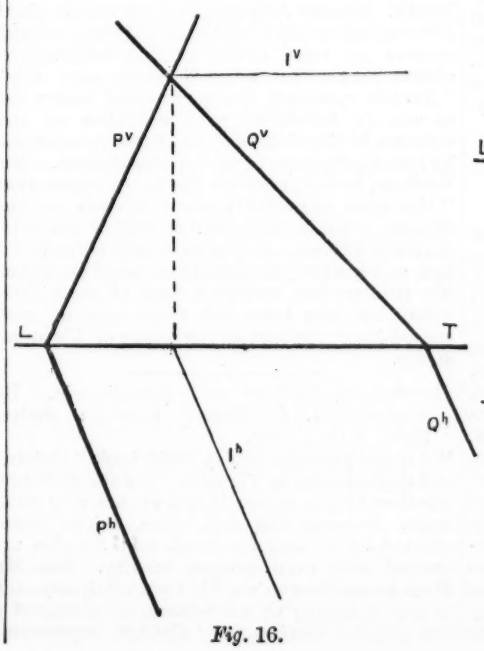


Fig. 16.

Intersection of two planes, P and Q, given by their traces.

We know that the points *m* and *n*, where the traces of the planes meet, are points of the intersection I; by connecting the plans and the elevations of *m n* we have I^h and I^v as in fig. 15.

If the planes have parallel traces, such as P^h and Q^h in fig. 16, or P^v and Q^v in fig. 17, then the projection of the intersection, I, will be parallel to the traces.

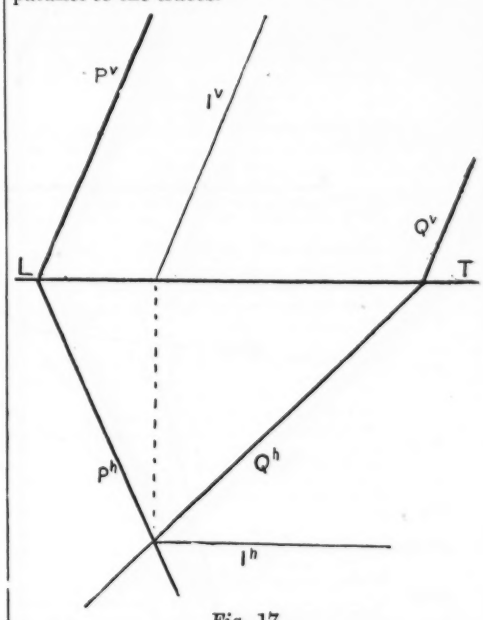


Fig. 17.

Intersection of two planes, P and Q, given by their traces, when their traces do not intersect within the limits of the drawing-paper.

This is accomplished by *the use of auxiliary planes.* You cut the two planes P and Q by a horizontal auxiliary plane R; the intersections of plane R with planes P and Q are the lines A and B, of which A^h and B^h are the plans, the point *m* where A and B cut one another is a point in the line formed by the intersection of the planes P and Q. By operating in the same way by the means of an auxiliary plane, S, parallel to the elevation, we find another point *n*, which also belongs to the intersection of the planes P and Q: the line *m n* is therefore the intersection required. (See fig. 18.)

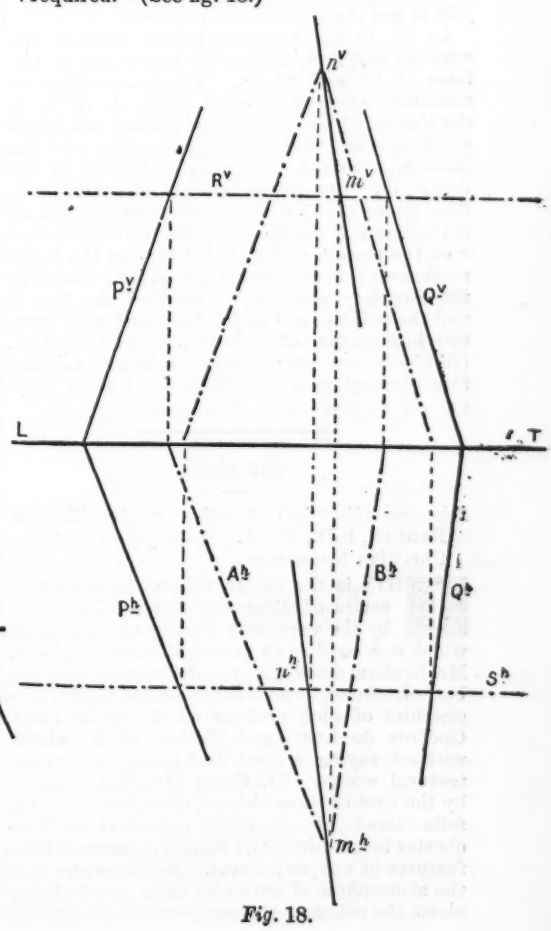


Fig. 18.

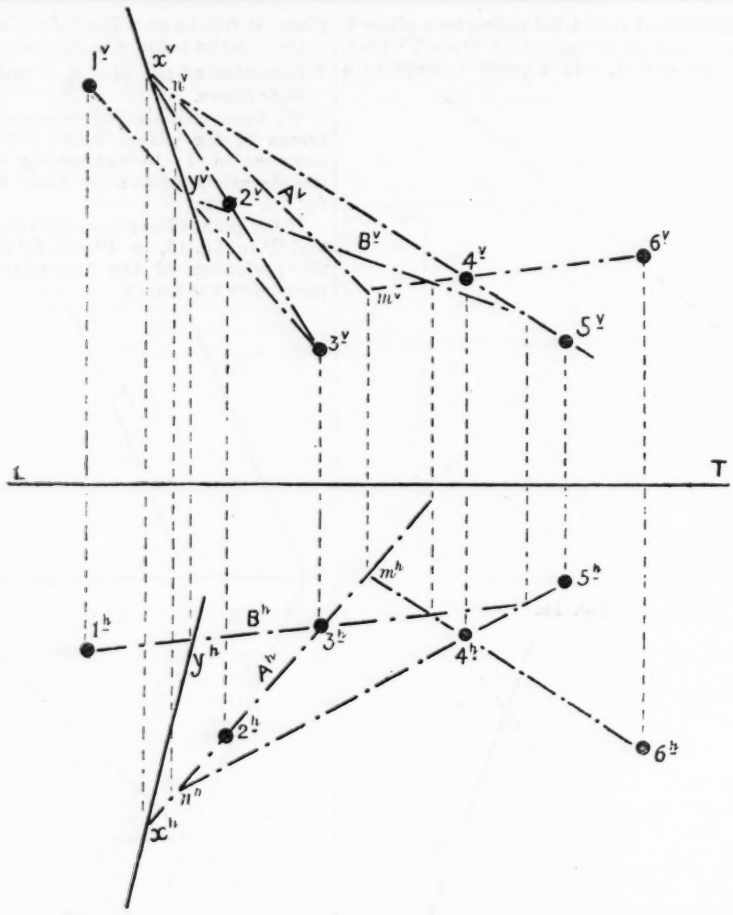


Fig. 19.

Intersection of two planes given each by three points belonging to their respective surfaces.

This is the case most likely to occur in practice, as, in architectural drawings, we have not to do with unlimited planes given by their traces, but with planes defined by lines or points belonging to them. Let the points 1, 2, 3 given in plan and elevation belong to the first plane, the points 4, 5, 6 belong to the second plane.

We use, in this case, the very same method as in the preceding one; that is, *we select auxiliary planes, the intersection of which with the planes given can be readily determined*, and we get thereby two points which we have only to join to get the intersection required.

In fig. 19 the auxiliary planes selected are vertical, and their horizontal traces are on the lines 1^h, 3^h, and 2^h, 3^h. The intersection of auxiliary plane 2, 3, with plane 4, 5, 6, is the line A, which is found by joining the intersections *m* and *n* of the auxiliary plane with the lines 4, 5 and 4, 6. A^h is of course on the line 2^h, 3^h. The intersection of the same auxiliary plane (2, 3) with the given plane (1, 2, 3) is the line 2, 3 itself; the point of intersection *x* of the lines A and 2, 3, belongs to the intersection of the two planes given. By means of the auxiliary plane 1, 3, we find the line B and the point *y*, and by joining *x* and *y* we have the intersection of the two planes as required. (*Students are particularly advised to re-draw this diagram on a large scale, many times varying the disposition of the planes.*)

Books.

Diocesan Histories: Winchester. By WILLIAM BENHAM, B.D., F.S.A. Society for Promoting Christian Knowledge.

THIS is the latest volume in the useful series of Diocesan Handbooks issued by the venerable Society above named, which now conducts a great publishing business. Mr. Benham deals chiefly with historical matters, but, of course, he finds it impossible to give biographies of such prelates as Henry de Blois, Godfrey de Lucy, and William of Wykeham, without saying a good deal about their architectural works. St. Cross Hospital, founded by the first of these bishops, though it naturally falls short of the noble cathedral of Winchester in grandeur and dignity, possesses some features of unique interest. Nowhere else does the atmosphere of antiquity cling more closely about the relics of the past,—nowhere else can one realise so well the character of a Mediæval religious house. Its restoration within the last few years has been singularly happy, having extended from the material fabric to its sometime notorious administration. Bishop Godfrey's work, in which is included all the east end of the cathedral from the back of the apse (excepting the Lady-chapel), is specially interesting, not merely on account of its architectural beauty, but from the fact that its date, 1202–1207, is accurately known. Wykeham is best known in connexion with the two colleges which he built and endowed, but he also left his mark upon the cathedral. Bishop Edyngdon, his predecessor, had begun the restoration of the nave; Wykeham pursued it, but in a very different way. Edyngdon pulled down the old Norman work to make room for his own improvements; Wykeham, on the other hand, retained Walkelyn's structure, but transformed it from Norman to Perpendicular by altering the mouldings of the undisturbed stones, or else by entirely encasing the Norman piers with new work. This singular treatment is shown with great care by Professor Willis, and is worthy of close examination.

Of the ecclesiastical buildings within the diocese of Winchester we must not speak at length. Romsey Abbey is an excellent example of Norman work, and Christchurch Abbey, though marred by later additions and mutilations, almost rivals it. Gilbert White says that, "Norfolk excepted, Hampshire and Sussex are as meanly furnished with churches as any counties in the kingdom"; but few persons will be found nowadays to accept this dictum. Mr. Benham, indeed, goes so far as to assert that "the most exquisite modern church in the diocese, if not in England," is that of the little parish of Privett. It was built only seven years ago, and has not yet attracted general attention. Mr. Benham has written a book of some little value, but has been too often content with second-hand authorities for many of his statements.

Sketches in Holland and Scandinavia. By AUGUSTUS J. C. HARE. London: Smith, Elder, & Co.; 1885.

WE might call this pretty little book "Holland and Scandinavia in Vignette," for the sketches, whether in pen or pencil, are upon a very small scale. Norway has less than thirty pages allotted to it, and Denmark and Sweden are treated with even greater brevity. But Mr. Hare knows how to use his tools efficiently, and is able to convey to his readers, by means of a few graphic touches, very distinct impressions of the places he has visited. His book will be of service to those who follow the author's steps, and of interest to those who are obliged to stay at home. Only we would recommend tourists to select the spring and not the autumn for their visit to Holland. If Mr. Hare had chosen the former season, he would have had far less occasion for groaning over the dulness and dreariness of the country and the mildewed stagnation of the towns. That the latter are not without features attractive to the artist and suggestive to the architect, Mr. Hare's sketches abundantly prove. The town gateways at Kampen and Zwolle are noble examples of Mediæval brickwork. The great church at Haarlem is, at any rate, externally, a striking edifice. At Utrecht there are quaint gabled houses, picturesque in their decay; and the same may be said of Breda, Dortrecht, and Alkmaar. Picture-lovers may spend pleasant hours at the Hague, Amsterdam, and Rotterdam, while at Delft and Leyden the antiquary may live in the past without an effort. We are glad to find that Mr. Hare, in his notice of Denmark, draws attention to Lübeck, which has been strangely neglected by tourists, though almost rivalling Nuremberg in interest. With Copenhagen he was charmed, and of the great Castle of Frederiksborg he says,—"Each view is more picturesque than the last. It is a dream of architectural beauty." Sweden he describes as pretty, but never rising to absolute beauty. A good sketch is given of the Church of Old Upsala, with its detached wooden belfry and apse, "built out of the Pagan sanctuary." Of course, in Norway he visited and sketched "the date-forgotten old wooden church" of Hitterdal, which resembles a Chinese pagoda more than anything in occidental architecture, and he is warm in his admiration of St. Olaf's Cathedral at Throndtjem, or, as we prefer to call it, Drontheim. But it is the natural scenery which attracts people to Norway, and there takes them captive. For such as desire to taste the sweets of that captivity, Mr. Hare's little volume will be found very useful.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

1,034, Cold-water Tap. R. Hallimond.

The valve of the tap is an indiarubber ball mounted on a spindle, which, in the upper part of the casing, is provided with indiarubber rings. The pressure of the water from the main keeps the valve closed, and it is opened by screwing down a small milled head-screw which is the top part of the spindle. When the tap is open and water has access to the upper part of the tap, the indiarubber packing rings are compressed, and thereby prevent any leakage through the top.

4,143, Pressure Regulator. J. Roff and others, of Melbourne.

This is a pressure regulator and economiser for gas, steam, water, and other pipes. A short conical tube is inserted in the piping so that the fluid current impinges on the small end and external surface. By properly proportioning the area of this orifice to the area of the pipe it is stated that uniformity of discharge and a consequent economy is insured. In applying the conical tube to piping it may either be made separate and fastened by screwing or otherwise, or it may be cast in one piece with the main pipe.

6,037, Roofing Tiles. J. and H. Grimbleby.

The tiles are formed with wings on one side and fillets or bars on the other, and interlock, forming weatherproof joints.

1,322, Improvements in Sliding Sashes, &c. F. Oldfield.

Instead of sash-cords, pulleys, &c., a stationary screw is placed in a groove formed on one side of the sash, and upon this screw is fastened a revolving nut, the outside of which is formed as a toothed pinion gearing into a bevel-wheel. A corresponding bevel wheel geared into this is keyed upon a spindle mounted in suitable bearings, which may be actuated by a winch-handle. By revolving this handle the sashes may be opened or shut as they slide in the frames with an easy movement.

8,172, Improvements in Weather Bars. W. Greenwood and Others.

This invention automatically moves the weather bars or strips attached to the bottom of doors as weather bars or strips. A system of rods and levers is attached to the door-post or lintel and the door, by which, as the door is opened, a rod is moved to the door's outer edge; and, in closing, the reverse motion is imparted to the weather bar until it is finally pressed down when the door is shut.

7,838, Cast-iron Skylight-frames. H. Steven and J. Walker.

The skylight-frame has two pivots or trunnions

attached to it which fit into and turn in recesses formed in two lugs. One of these lugs is permanently fixed to a plate on the roof; the other is movable and is kept in place by means of a screw, which engages with a nut inside it. The screw can be inserted or removed from the inside of the house. When the skylight is put on, one pivot is fitted to the fixed lug and the other lug is then put on over the other pivot and screwed down. By this means unlawful entrance is rendered more difficult.

4,607, Improved Sash Frame Pulley. S. Guinery.

The front of this pulley represents three circles, one under the other in a direct line, and slightly intersecting each other. In the centre there is the usual opening for the pulley wheel and cord, and near the bottom there is a frame cast on the back of the front face to receive the wheel. This frame is closed at the bottom, but open at the back and top. The sides form the bearings on which the axle of the wheel revolves; the back portion of these sides is higher than the front, and inclines sharply down towards the front, terminating at the point where the axle works. By this arrangement the wheel put in at the back slides down the incline to its bearings, requiring no fitting, and when fixed on the window-frame, it cannot come out. To fix the improved pulley, which is made slightly larger in front than at the back, it is only necessary to bore three holes of a corresponding size with a centre-bit and drive it tightly in with a mallet; but in order to prevent the possibility of its getting loose, holes for screws are provided just inside the front, and as the wheel will readily recede from the front up the inclined sides, they may be easily inserted.

4,856, Improvements in Ornamenting Bricks, &c. W. R. Cornell.

The surface of the brick, block, or such like article is given a thin coat of cement. In this layer is fixed pieces of glass, earthenware, paper, or metal, according to the design or pattern to be followed out. They can either be pressed in flush or allowed to stand out in relief. The bricks are afterwards baked and the cement hardened.

5,845, Chimney Pots. E. S. Romilly.

A pipe, whose upper part is made conical, is fitted with the smaller end uppermost to the upper end of the chimney. Surrounding this, and extending above it is a second pipe, slightly conical. The lower end of this pipe either forms part of or is fastened to the first pipe, or it may rest and be fixed upon a ledge or flange round the pipe at or below where the conical part begins. Apertures are made where the annular space between the two pipes commences, so that any air entering through these apertures will be deflected upwards, and induce an upward current through the inner pot.

6,306, Grease or Gully Trap for Sinks. E. Page.

The trap consists of a glazed stoneware box, rebated round the top to receive a cast-iron cover, which is set in cement. The box is divided by a partition, which does not reach the bottom, but dips below the surface of the water, forming the trap. One compartment is connected with the waste-pipe from the sink, and the other with the drain, and the object is to prevent the grease from the sink passing down the drain. This is effected by a galvanised wire cage, which is placed in the compartment connected with the sink, and which may be removed for cleaning through a hinged grating in the cast-iron cover.

APPLICATIONS FOR LETTERS PATENT.

Jan. 23.—960, A. Graham, Self-Acting Bolt Fasteners for Cupboard Doors, &c.—968, H. Fletcher, Improvements in T-squares. — 993, T. Palmer, Clamps or Clamping Presses.—996, J. Stanley, Manufacture of Pigments or Colours.—1,003, S. Meacock, Apparatus for Indicating the Occupation of Rooms, Closets, &c.—1,014, J. Callow, Stencil Plates for Graining, &c.

Jan. 24.—1,033, E. Hill, Hanging and Supporting Window-sashes.—1,057, H. Thompson, Arrangement of Boilers in connexion with Closed Kitchen Ranges and other Grates and Stoves.

Jan. 26.—1,090, D. Ward and G. Hayward, Socket Chisels and Gouges.—1,091, B. Sutcliffe, Machinery for Planing, Moulding, Grooving, Tongueing, and Thicknessing Wood.—1,102, R. Warwick, Colouring and Permanently Decorating Surfaces of Plastering Work.—1,104, A. Brookes, Door and other Locks and Latches.

Jan. 27.—1,132, J. Watts, Endless Band-saw Machines.—1,165, G. Garrod, Automatic Shutters, Gates, or Doors for Closing the Openings of Lifts, &c. -1,166, H. Walker and G. Clark, Improvements in Kitchen Ranges.—1,170, W. Bull & J. Lennox, Machinery for Pressing or Moulding Pulverised Material into Bricks, Blocks, &c.—1,172, W. Harling, Improvements in Levels, 1,173, W. F. Gillett and H. Moreton, Ventilating Apparatus.

Jan. 28.—1,203, E. Heathcote, Improvements in Kitchen Ranges.—1,214, P. Gray, Apparatus for Facilitating the Ascent of Factory or other Chimneys.—1,223, J. Osborn, Improvements applicable to Stoves and Ranges.—1,230, G. Turnbull, Improvements in Kitchen Ranges.

Jan. 29.—1,257, J. Lee, Wrought Metal Trowels. —1,259, E. Glatzel, Utilisation of Zinc Refuse.—1,269, E. Beal, Improvements in Window Fastenings.—1,284, J. Horne, Appliance for Breaking up Solid Refuse in Sewers or Drains.—1,291, H. Walker and R. Carey, Hydraulic Lifts.

Jan. 30.—1,326, P. Okell, Construction of Chairs. —1,340, W. Gedge, Machinery for Cutting, Planing, and Shaping Wood.—1,354, J. Dinning, Composition for Removing Old Paint, Varnish, &c.—1,355, G. Campbell, Improvements in Fire Grates.

Jan. 31.—1,366, W. Thicthener, Sanitary Ventilator. —1,372, F. Nannestad, Smoke Preventer. —1,375, J. A. Ewen's Swivel and Plug Joints for Gas Connexions, &c.—1,379, G. Oulton, Soldering Irons. —1,382, H. De Berenger, Plaster Ceilings and Walls. —1,385, W. Bain, Standards or Posts for Fencing.—1,388, A. Reddie, Machine for Sharpening and Setting Saws.—1,408, T. Amos, Improvements in Water-closets.—1,410, H. Pearson and G. Morris, Street Gully Traps.

Feb. 2.—1,436, J. Wright, Seats and Covers of Privies, Water-closets, &c.—1,443, R. Stoffert and T. Dykes, Improvements in Girders.—1,448, J. Muller, Imitating Majolica Ware.

Feb. 3.—1,460, J. Holden, Ventilating and Smoke Consuming.—1,461, A. Lineff and W. Jones, Brick-cutting Tables.—1,476, W. Walton, Ascending Tall Chimneys, Shafts, Spires, Lofty Buildings, &c.—1,486, H. Brown, Smoke Preventer.—1,488, J. Bennison, Improvements in Domestic and other Fire Grates.—1,504, O. Flagstad, Construction of Windows.

Feb. 4.—1,522, F. Cunliffe, Improved Lavatory Appliance. —1,539, J. Walker and H. Worsey, Attaching Door and other Knobs to Spindles.

Feb. 5.—1,577, F. Commin, Economising Space occupied by Mortise Door Locks and Latches.—1,596, R. Wilson and others, Chimney Tops.—1,604, T. Pearse and M. Beardsley, Preservative Composition for Painting, &c. —1,626, R. Evered, Flushing Cisterns.

PROVISIONAL SPECIFICATIONS ACCEPTED.

5,721, W. and G. Rockcliffe, Metal Handrail Stanchions.—13,874, G. Henderson and D. McNeil, Water-waste Preventers.—15,726, W. D. Cliff, Constructing Glazed Brick Walls.—16,480, W. J. Reynolds, Lock-action Fastener for Window Sashes.—16,486, A. J. Boult, Alarums for Shop Doors, &c.—16,630, F. Trier, Machinery for Dressing, Shaping, and Moulding Stone.—16,672, E. Wright, Chimney Cowl and Ventilator.—17,066, W. Parr, Preventing the Passage of Air, Dust, and Water past doors.—11,983, C. Henderson, Warming and Ventilating Buildings.—16,922, P. Corcoran, Machinery or Apparatus for Dressing Stone.—117, J. Bennison, Chimney Pots for Preventing Down-draught and Curing Smoky Chimneys.—15,422, P. Walker, Portland Cement Tiles. — 16,471, A. Cordingley, Ornamental Decorations.—16,593, F. Mitchell and H. Townsend, Portable Machine for Trimming the Edges of Paper-hangings. — 16,781, J. Walker, Window Sash Fasteners. — 16,792, G. Ross, Laying and Securing Slates.—16,943, S. Willett, Securing the Meeting bar of Sash-Fasteners.—17,103, A. Mullord, Venetian Blind Laths.—363, A. Reddie, Improvements in Bakers' Ovens.—679, T. Fletcher, Swivel Joints for Gas, Water, and Other Pipes.—10,717, W. J. Holmes, Syphon Water-waste Preventer for Flushing Purposes.—15,048, W. Macrone, Manufacture of Varnishes and Sizes.—16,679.—G. Collings, Improved Sash Fastener.—16,872, T. Lythgoe, Sanitary Slopstone.—16,893, J. Gillespie, Improvements in Bricks for Furnaces and in Concrete Walls.—17,924, F. Bond, Pervious Fire Bricks.—60, H. Robinson, Roofing Tiles.—101, T. Greenwood, Improved Hinge.—136, A. M. Clark, Improved Construction of Girder.—166, T. Fielder, Brick Mould Stock.—217, W. Court, Wood Block Flooring.—264, J. Walker, Cupboard and other Door Fastenings.—486, J. Hancock, Producing Ornamental Devices on Glass.—579, S. Graham, Combination Ladder.—968, H. Fletcher, Improved T-squares.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to opposition for two months.

4,699, H. Dow, Improved Chimney Cowl.—5,194, H. Hart, Manufacture of Bricks.—16,818, M. Ismay, Automatic Closing of Doors.—3,123, W. Allen, Fixing Grates and Chimney-pieces. — 3,481, T. Whittaker, Presses for Bricks, Tiles, &c.—5,057, A. Geary, Wooden Block Flooring and Securing same. —5,064, W. Tickelpenny, Fireproof Floors and Ceilings.—5,192, J. Martin, Manufacture of Red Pigments or Paints.—5,255, W. Tuffee, Improved Coping Tile.—5,676, H. Buchan, Regulating the Supply of Water to Water-closets.—53,888, R. Lowe, Sash Windows.—5,895, C. Harcourt, Manufacture of Hinges.—6,107, G. Greig, Ventilating Apparatus.—6,178, T. Brown, Chimney Cowls and Ventilators.—6,774, T. Herbertson and R. Pollock, Downcast Ventilator.—15,665, J. Davis, Wood Pavements.—4,950, J. Garret, Construction of Earth-closets.—5,473, R. Middleton, Brick-making Machinery.—4,978, P. O'Connor, Spring Hinges for Doors. —5,665, J. Greathead, Tunnelling Apparatus.—5,680, J. Pinchen, Improvements in Glazing.—7,468, C. Haigh, Screwdrivers.—15,999, A. Graffy and L. Wadack, Hydraulic Apparatus for Preventing the Slamming of Doors.—16,114, E. Kretzner, Brick Presses.—16,968, J. Griffin, Wrought-iron Window Frames.—5,843, W. Lake, Combined Washstand and Step-ladder.—5,880, W. Moyes and Others, Water-closet Basins.—5,881, T. Robb, Jointing or Connecting together Tiles and Wooden Blocks or Slabs for Paving, &c.—15,334, F. Hobbs, Set Cementing for Lead-light Glazing.—39, S. Hooper, Euphorbia Paints.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

FEBRUARY 4.

By HARDS, VAUGHAN, & JENKINSON.

Greenwich—17 to 21, Albion-street, 22 years, ground-rent 15*l.* 4*s.*	£565
126, Greenwich-road, 58 years, ground-rent 7*l.*	460
38, 39, and 40A, Ashburnham-grove, 60 years, ground-rent 12*l.*	910
27, Ashburnham-road, and a ground-rent of 12*l.* 12*s.* per annum, 62 years, ground-rent 16*l.* 16*s.*	230

FEBRUARY 9.

By — CHAMPNESS.

Chadwell, near Ilford—"The Orchard," and 14½ acres, freehold	2,950

FEBRUARY 10.

By R. PERKINS.

Poplar—1 to 4 and 7 to 10, Bromley-place, freehold	1,350
Camberwell — 46, 48, and 52, Denmark-road, freehold	1,380
Buckhurst Hill—1 and 4, Oakley Villas, freehold	580

FEBRUARY 11.

By GEORGE GOULDSMITH, SON, & Co.

South Kensington—87, Gloucester-road, 66 years, ground-rent 10*l.*	3,3.0

F. ELLIS MORRIS.

Islington—75 and 77, Oakley-road, 56 years, ground-rent 11*l.*	930

FEBRUARY 12.

By FAREBROTHER, ELLIS, CLARK, & Co.

Regent's Park, Alpha-road—"Oakley House," and 1¼ acre, 20 years, ground-rent 40*l.*	2,250
Russell-square — 31, Bedford-place, 13¼ years, ground-rent 52*l.* 10*s.*	550
Mecklenburgh-square — 4, Heathcote-street, 25 years, ground-rent 12*l.*	410

By THURGOOD & MARTIN.

Wandsworth Common—58, Bellville-road, freehold	400

By NEWBON & HARDING.

Bermondsey—135 to 157 odd, St. James's-road, 48 years, ground-rent 42*l.* 7*s.*	2,990
Kennington Park—19, 20, 21, and 22, Lucas-road, 40 years, ground-rent 20*l.*	815
Nos. 8, 10, and 12, Otto-street, 39 years, ground-rent 15*l.*	605
Goswell-road—No. 182, term 9 years, ground-rent 10*l.*	165
South Hackney—67 to 73 odd, Cassland-road, 65 years, ground-rent 16*l.*	1,670

By WILKINSON & SON.

Brighton—40, Cannon-place, freehold	1,780

FEBRUARY 13.

By C. W. MILLAR.

Tottenham Court-road—47, 49, 51, 51a, 53, and 53a, Huntley-street, freehold	4,230
Regent's Park—33, St. George's-square, 51 years, ground-rent 12*l.*	700

MEETINGS.

SATURDAY, FEB. 21.

Edinburgh Architectural Association.—Visit to Calton Jail.

MONDAY, FEB. 23.

Royal Academy.—Professor C. T. Newton on Sculpture: "The School of Praxiteles." II. 8 p.m.

Surveyors' Institution.—Discussion on Messrs. R. W. Mann's and H. Martin's papers on "Leasehold Enfranchisement." 8 p.m.

Society of Arts (Cantor Lectures).—Mr. J. M. Thomson on "The Chemistry of Pigments." I. 8 p.m.

Leeds and Yorkshire Architectural Association. — Mr. Cole A. Adams on "Architectural Competitions."

Edinburgh Architectural Association. — Mr. J. C. Watt on "The Poetic Aspects of Architecture." 8·30 p.m.

Inventors' Institute. 8 p.m.

TUESDAY, FEB. 24.

Builders' Clerks' Benevolent Institution.— Eighteenth Annual General Meeting. 7 p.m.

Institution of Civil Engineers.—Discussion on Messrs. B. Baker's and Wolfe Barry's papers on the Metropolitan and District Railways. 8 p.m.

Royal Institution.—Prof. Sidney Colvin on "Museums and National Education." II. 3 p.m.

St. Paul's Ecclesiological Society.—Mr. Arthur Taylor on "The History of Stained Glass." 7·30 p.m.

WEDNESDAY, FEB. 25.

Royal Academy.—Lectures on Sculpture: Mr. R. Stuart Poole, LL.D., on "Pisano as a Medallist." 8 p.m.

Carpenters' Hall, London Wall (Free Lectures to Artisans).— Professor Church on "Black, White, and Red Lead." 8 p.m.

British Museum.—Mr. W. St. C. Boscawen on "Assyrian and Babylonian Antiquities.—I. The Chaldean Temple, its Construction, Symbolism, and Services." 2·30 p.m.

Civil and Mechanical Engineers' Society. — Mr. R. Nelson Boyd on "The Petroleum Fields of Europe." 7·30 p.m.

Surrey Archæological Society.—Annual Meeting. 5 p.m.

Society of Arts. — Mr. W. D. Scott Moncrieff on "Methods of Supplying Steam-Boilers with Water." 8 p.m.

THURSDAY, FEB. 26.

Royal Academy.—Mr. J. E. Boehm, R.A., on "Bronze Casting as applied to Sculpture." 8 p.m.

Parkes Museum of Hygiene. — Professor H. Robinson on "River Pollution." 8 p.m.

Society of Arts (Applied Chemistry and Physics Section). Dr. Frederick Siemens on "Tempered Glass." 8 p.m.

Society for the Encouragement of the Fine Arts.—Mr. C. Pfoundes on "The Folk-lore and Art of Old Japan." 8 p.m.

Society of Telegraph-Engineers and Electricians.—(1) Discussion on Mr. J. A Timmis's paper on "The Working of Railway Signals and Points by Electro-Magnets." (2) Sir David Salomons on "Constant Electro-Motive Force in an Electric Light Circuit." 8 p.m.
Society of Antiquaries.—8·30 p.m.

FRIDAY, FEB. 27.

Royal Academy.—Mr. F. C. Penrose on "Greek Architecture." 8 p.m.
Institution of Civil Engineers.—(*Students' Meeting*).—Mr. H. T. Turner on "The Gauging of Flowing Water." 7·30 p.m.
British Museum.—Professor J. F. Hodgetts on "Mediæval English Remains." II.—The English. 2 p.m.

SATURDAY, FEB. 28.

Architectural Association.—Visit to Houses in Collingham-gardens and St. Paul's School, Kensington. Assemble at School at 3 p.m.
Builders' Foremen and Clerks of Works' Institution.—Annual Dinner. Holborn Restaurant. 6·30 p.m.

Miscellanea.

Society of Antiquaries of Scotland.—At the monthly meeting of this Society, held in Edinburgh last week, the first paper read was a notice of the recent excavation of St. Ninian's Cave, Glasserton, Wigtownshire, by Sir Herbert Eustace Maxwell, bart., M.P. In Sir Herbert's unavoidable absence, the paper was read by Mr. J. R. Findlay, the secretary. Local tradition has long assigned to this cave the honour of having been the retreat chosen by St. Ninian for purposes of prayer and meditation. In 1871 it was visited by the late Dean Stanley, and an incised cross was discovered on the rock near the entrance. Last year some other crosses were discovered on detached stones, one of which was presented to the National Museum by Mr. Johnston Stewart, of Glasserton. The explorations now described were undertaken in June last for the Ayr and Wigtownshire Archæological Association, and resulted in the discovery of a number of indications of the use of the cave in by-past ages,—first as a simple shelter, and latterly as a chapel and place of pilgrimage. The second paper was a description of the Church of St. Clement at Rowdill, in Harris, by Mr. Alexander Ross, architect, Inverness, F.S.A.Scot. This church, situated at the south-east angle of the island, is cruciform in plan, with a square western tower. At some time it seems to have become ruinous, and the upper part of the walls of the nave and tower have been rebuilt from old materials without much regard to character or design, a number of fragments of old moulded corners and sculptures having been built into the tower promiscuously, and the figures placed in most unlikely positions. The lower portions of the walls of the nave, the transept arches, and the side and end windows of the chancel end are evidently of early date. The third paper was a notice by Sir Walter Elliot of Wolfelee, F.S.A.Scot., of two very curious masks of bronze, found some time ago about 1 ft. 3 in. under the surface in a coffee plantation at Canajore, in the Province of Mysore, India, and presented to the Museum by Mr. R. C. Sanderson.

Goulbourn Cathedral, New South Wales. Messrs. Heaton, Butler, & Bayne, of Garrick-street, London, have just shipped two large stained-glass windows for Goulbourn Cathedral, one for the east end of the chancel and the other for the north transept. The east window consists of seven long lights and elaborate tracery in the Decorated style, and is filled with figure work very richly coloured, illustrating "The Angel's Appearance to the Shepherds," "Christ as a Child in the Temple," "Baptism," "Sermon on the Mount," "Crucifixion" and "Ascension." In the numerous pieces of tracery above the lights are emblems and Christian symbols. The window is to be erected as a memorial of William and Emily Elizabeth Bradley, at the cost of their daughters. The north transept window, consisting of six lights and tracery, contains eighteen figure panels from the Old Testament history, which subjects are arranged in bands of colour across the window, having pattern-work between. This window is in memory of Thomas Sutcliffe Mort, and has been executed under the supervision of Mr. J. D. Crace, of Wigmore-street, on behalf of the Mort family. These windows have cost about 1,000*l.*

Registration of Titles.—The committee of the Building Societies' Protection Association are about to offer prizes for the best essays on this subject, more especially with reference to dealings with smaller classes of property, such as constitute the main portion of the transactions of building societies.

Combination of Employers and Workmen.—A meeting of the employers and workmen in the nut and bolt trade was held on Monday night at Darlaston to consider what action shall be taken with regard to underselling by certain firms in the district. Mr. A. Keen, J.P., presided, and there was a large attendance. It was pointed out that some of the employers were selling goods at a price which left little or no profit, and that the men were consequently threatened with a reduction of 10 per cent. in their wages. The meeting represented four-fifths of the trade, and representatives of men and masters spoke against the proposed reduction; after which a resolution was passed to the effect that the time had arrived when there should be complete union between the employers and workmen engaged in the trade. Another resolution was also agreed to that, as the action of employers and workmen outside the trade association was seriously injuring the prospects of trade, the meeting was of opinion that employers should employ none but associated workmen, and that workmen should only work for associated employers.

New Buildings in Birmingham.—The annual return by Mr. Lloyd, the buildings surveyor, of new buildings for which plans were approved by the Borough Surveyor during the year 1884, has just been published. From this it appears that numerically there has been a slight improvement in number of new buildings, including alterations, upon the two previous years, as follows:—

	1884.	1883.	1882.
Houses	922	876	601
Shops	62	62	65
Churches	1	2	2
Chapels	—	2	—
Schools	5	1	6
Manufactories and Warehouses	24	37	64
Miscellaneous	187	97	62
Alterations, &c.	84	158	163
Totals	1,285	1,235	963

947 notices to property-owners and others relating to dangerous structures have also been sent out during the year, as against 767 in 1883.

The Safety of Theatres in Glasgow.—At the meeting of the Glasgow Town Council last week, the special committee charged with the consideration of the matter submitted regulations to be observed in the construction of all buildings intended for theatres or music-halls, as well as drainage. After much discussion, the regulations were again remitted to the committee, the general opinion being that they were insufficient. Bailie Richmond, in protesting against delay, remarked that there were music-halls and other halls in Glasgow that were simply in a scandalous condition, and the Council were not doing their duty as representatives of the public if they did not call the attention of the Lord Advocate to the state of matters at once. He added that there were holders of such places who, just because they knew the authorities had not the power to force them, were not using any means to improve matters.

Society for the Encouragement of the Fine Arts.—Mr. George C. Haité, author of "Plant Studies," and member of the Council of the above-named Society, read an interesting paper to members of the Society at the rooms in Conduit-street on February 12. The subject was "Wall-papers and their Manufacture," and to illustrate his discourse the lecturer had provided copper and wooden blocks, arsenical papers, and many non-arsenical papers of the present day, including designs by E. W. Godwin, F.S.A., Walter Crane, Lewis F. Day, and the lecturer himself. Representatives of the leading town and country paper-houses were present. Mr. Cave Thomas, F.S.A., kindly took the chair in the unavoidable absence of Mr. E. W. Godwin.

Free Libraries for Glasgow.—A meeting was held in the City Hall, Glasgow, on Monday evening, under the presidency of ex-Lord Provost Ure, in favour of the adoption of the Public Libraries Acts. The attendance, which was large, included many prominent citizens. Resolutions declaring that the Acts have been of great advantage elsewhere, that further delay in their adoption in Glasgow would be unworthy of the city, that until the Acts were adopted the full benefits of the Mitchell, Stirling, and Glasgow Libraries could not be obtained, and pledging the meeting to support the committee in the matter, were unanimously agreed to.

Civil and Mechanical Engineers' Society An ordinary meeting was held on the 11th inst., the President, Mr. Cole, M.Inst.C.E., in the chair, when Mr. B. Haughton, C.E., read a paper entitled "Indian Railway Network, 1884." The principal points taken up by the author were,—(1) The Physical Geography of India as it applies to the Rivers and Mountain Ranges which in every Country affect its Railway Network; (2) The General Character of the Railway Network; (3) An Indo-European Railway and its connexion with the Indian Lines; (4) The Indian Railway Gauges; (5) Financial Position of the Railways. A discussion followed, and the proceedings terminated with a vote of thanks to Mr. Haughton for his paper. The next meeting will be held on the 25th inst., when Mr. Nelson Boyd, M.Inst.C.E., will read a paper on the "Petroleum Fields of Europe," in lieu of the paper previously announced, by Mr. Burge, M.Inst.C.E.

A New Board School.—On Monday last Mr. Buxton, Chairman of the School Board for London, opened the new school in Surrey-lane, Battersea Bridge-road. The school, which is one of the most imposing buildings of the 307 of a similar character which have been opened in London, will accommodate 480 boys, the same number of girls, and 632 infants,—a total of 1,592. The site, which occupies an area of 74,054 ft., cost, including legal expenses, 3,458*l.*, or 2*l.* 4s. 3d. per head, and the building 15,068*l.*, or 9*l.* 12s. 11d. per head, making a total cost of 18,527*l.* 12s. 5d., or 11*l.* 17s. 2d. per head. An interesting and novel feature in connexion with the school is a workshop, in which Mr. Toombs, the head-master, proposes to teach the boys the use of various simple tools, how to execute trivial repairs, and in other ways to make them on leaving school handy and intelligent lads.

Constructional Ironwork. — Messrs. Rownson, Drew, & Co. send us a very well illustrated catalogue of constructional iron-work, beams, trusses, sections of roofs, fire-proof floors, &c., as carried out by them. Their iron tank construction appears very satisfactory; occasional serious failures in such tanks render this an important matter. In the combination of iron beams and concrete we observe that, as in other illustrated catalogues of the same class, the influence of the concrete in resisting compression, and thus rendering possible the reduction of the area of the upper flange of the beam, is not taken into account. So much has been said, and so many experiments made in regard to this, that it is odd that it should be so constantly overlooked.

Sunday Exhibition Opening.—The Council of the Institute of Painters in Oil Colours, Piccadilly, have generously placed their present Exhibition at the disposal of the Sunday Society, and it will accordingly be open next Sunday to the members of the Society and their friends; and on Sunday, March 1st, the Exhibition will be open to the public by tickets, which may be had free by all who make written application to Mr. Mark H. Judge, the Honorary Secretary, No. 8, Park-place Villas, W., the only condition being that each applicant must send a stamped and addressed envelope for the reply.

Masons' Strike at Cardiff.—Last week the masons employed at the new Roath Dock, now in course of construction by Messrs. Nelson & Co., at Cardiff, to the number of 150, struck work against an infringement of their local rule by which their working hours are regulated. As one result, upwards of 500 other men who were no parties to the dispute have been thrown out of work. By the latest accounts, however, a foreman who had made himself obnoxious to the masons, and whose discharge was demanded by the men, has gone away, and the men were to resume work on Thursday morning last.

Clerks of Works' Reports.—Johnston's registered "Clerk of Work" Report Sheets (published by Morison Bros., 99, Buchanan-street, Glasgow), of which a specimen has been sent to us, are very compactly arranged, and will be found exceedingly convenient and time-saving. Although published in Scotland, they are applicable for use in all parts of the kingdom.

Post-Office, Inverness.—According to the *Scotsman*, it has been definitely arranged that new and more commodious premises will be erected for the Inverness Post-office, on a site fixed upon in a street at present being constructed in a central part of the town. The building will cost not less than 10,000*l.*

The Proposed Park at Dulwich.—A deputation from the Vestry of St. Luke's has waited upon the Charity Commissioners at Whitehall to solicit the interference of the commissioners with the proposals of the governors of Dulwich College to make a free gift of 72 acres of land to the Metropolitan Board for the purpose of a public park in South London. The arguments were that the property in question was held upon trust for the joint benefit of four metropolitan parishes,—namely, St. Botolph's, Bishopsgate; St. Saviour's, Southwark; St. Luke's, and Camberwell,—and it should be used for the educational purposes for which it was left. Sir Seymour Fitzgerald, in reply, said the Commissioners were appointed for a special purpose, and it would be entirely beyond their functions to express an opinion upon a matter which was before Parliament.

St. Michael's New Schools, Little Harwood.—Mr. Lowe, architect, Manchester, who was called in to adjudicate upon the plans sent in to the committee formed for the erection of new schools at Little Harwood, in connexion with St. Michael's Church, has chosen those of Mr. F. Robinson, Derby and Blackburn, as the first in order of merit, and those of Mr. J. W. Shorrock and Messrs. Stones & Gradwell as second and third respectively. The design of Mr. Robinson will be carried out. It is only proposed to erect, in the first instance, the infants' school, to be used also as a mission-room on Sundays. The building will be Gothic in style, and is estimated to cost about 1,000*l.*

Dundee.—At a meeting of the School Committee of the Dundee School Board on the 5th inst., plans of Rosebank and Butterburn Schools, amended in accordance with the suggestions of the architect for the Education Department, were submitted by Mr. Maclaren. The plans for Rosebank showed accommodation for one hundred additional scholars, and those for Butterburn additional accommodation for thirty-four scholars. The committee approved of the plans, and instructed that they should be forwarded to the Education Department for approval.

Swinton.—At a meeting of the Church-building Committee, Swinton, near Rotherham, Mr. H. L. Tacon, of Rotherham, was appointed architect for proposed section of a church to be built at Swinton Bridge.

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Proposed Asylum at Hartwood	Glasgow District Board of Lunacy	10 at 50*l.*	Feb. 28th	ii.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Kerbing and Asphalting Footpath	Tottenham Local Board	— De Pape	Feb. 24th	xxi.
Hire of Horses	St. Giles's Brd of Wks.	G. Wallace	do.	xxi.
Wooden Sleepers	Great Western Ry. Co.	*Official*	do.	ii.
Bedsteads, Pillows, Deal Tables, &c.	Guardians, Parish of Lambeth	do.	do.	xx.
Street Watering	Strand Board of Works	do.	Feb. 25th	xxi.
Wrought-Iron Girder Bridge	Leicester Corporation	J. Gordon	do.	ii.
Execution of Works	Hackney Board of Wks	J. Lovegrove	do.	xx.
Supply of Materials, and Execution of Works	Vestry of the Parish of St. George-in-the-East	*Official*	Feb. 26th	xxi.
Conversion of Athenæum Building, King's Lynn, into a Post-Office	Com. of H.M. Works...	do.	Feb. 27th	ii.
Custom-House & County-Court Offices, Swnsea	do.	do.	do.	ii.
Supplying and Laying Cast-Iron Pipes, &c.	Warminster Local Brd.	E. Easton & Co.	Feb. 28th	xxi.
Extending Concrete Sea-Wall, &c.	Bray Township Commissioners	P. F. Comber	March 2nd	xxi.
Fittings to Post-Office, Nottingham	Com. of H.M. Works...	*Official*	do.	ii.
New Post-Office, St. Alban's	do.	do.	do.	ii.
Construction of Brick Sewer	Paddington Vestry	do.	do.	ii.
Works and Materials	Surbiton Improvement Commissioners	do.	do.	ii.
New School	Trustees, Wesleyan Chapel, Sandwich	W. P. Beal	March 3rd	xxii.
Making-up Roads	Wandsworth B. of Wks.	*Official*	do.	xxi.
Main Drainage	Finchley Local Board...	G. W. Brumell	do.	ii.
Supply of Various Materials	Fulham Board of Wks.	*Official*	March 4th	xx.
Temporary Timber Foot-Bridge, &c., Battrsea	Met. Board of Works	do.	March 5th	ii.
Carrying away of Slop and Rubbish	Vestry of the Parish of Lambeth	Hugh McIntosh	do.	xx.
Works and Materials	do.	do.	do.	xx.
Sewage Works	Frome U.S.A.	P. Edinger	March 6th	ii.
Construction of Subsidence Tanks, &c.	do.	do.	do.	ii.
Annual Contracts	Lewisham Brd. of Wks.	*Official*	March 10th	xx.
Widening of Queen's Bridge	Belfast Corporation	J. C. Bretland	March 14th	ii.
Hospital for Infectious Diseases	Wrexham R. S. A.	A. C. Baugh	March 18th	xxii.
New Baths	Stockport Corporation	A. M. Fowler	March 20th	ii.
Construction of Main Sewers, &c.	Farnham Local Board	J. Lemon	March 23rd	xxi.
Finishing Four Houses	G. Miller	.....	Not stated	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Assistant	Boro'. Enginr, Tynmth.	12*l.* to 14*l.* per month	Feb. 23rd	xviii.
Assistant Surveyors, R.E. Dept.	Civil Service Com.	Not stated	March 4th	xviii.

TENDERS.

Accepted for the renovation of St. Paul's Church, Wolverhampton. Mr. J. R. Neall, architect:—Messrs. J. & W. Cockerill, Wolverhampton:—

For the roofing	£227	0	0
For the reseating in pitch pine	495	5	0
For stone reredos and Commandment tablets	157	0	0
For flues, &c., for heating apparatus	41	10	0
Heating Apparatus and Boiler.			
Jones & Attwood, Stourbridge	100	0	0
Interior Painting and Decorations.			
M. Tatlow, Wolverhampton	£120	0	0

Accepted for alterations and additions to St. Boniface (R.C.) Church, Union-street, Whitechapel. Mr. C. A. Legg, architect, Mile End:—

Calnan & Co	£700	0	0

For making a new road and laying down pipe sewer and surface-water drain on the Earl of St. Germans' Estate, Catford, Kent. Quantities supplied by Mr. Sidney Young:—

Nowell & Robson	£4,555	0	0
Dunmore	4,525	0	0
Hobbs	4,250	0	0
Blackmore	3,868	0	0
Beadle Bros.	3,715	0	0
Pizzey	3,697	0	0
Woodham & Fry	3,489	0	0

For additions to Somerset House, High-road, Tottenham, for Mr. W. H. Fowler. Messrs. D. Campbell & Son, architects. Quantities supplied:—

Humphreys	£1,175	0	0
Rider	1,070	0	0
Fairhead & Son, Enfield	986	0	0
Knight	983	0	0

For rebuilding the Jamaica Coffee House, St. Michael's-alley, Cornhill. Mr. Banister Fletcher, architect:—

				Deduct if Bath stone.		
J. Dover	£9,970	0	0	£883	0	0
W. Brass & Son	9,374	0	0	450	0	0
Lawrence & Son	8,657	0	0	500	0	0
J. Mansbridge	8,430	15	7	596	12	0
B. E. Nightingale	8,164	0	0	600	0	0
Higgs & Hill	7,942	0	0	490	0	0
Perry & Co.	7,695	0	0	625	0	0
J. Anley	7,502	0	0	290	0	0
W. Downs	7,389	0	0	315	0	0
W. Oldrey*	7,1[illegible]3	0	0	700	0	0

* Accepted.

[Architect's estimate if Bath stone, 6,410*l.*]

For a new house at Harrold, Beds (exclusive of grates, chimney-pieces, tiled hearths, and hall floor), for Mr. Charles Pettit. Mr. John Day, architect, Bedford:—

White, Bedford	£2,557	0	0
Foster, Kempston	2,400	0	0
Kimberley, Banbury	2,300	0	0
Wart[illegible]n, Bedford	2,142	0	0
C. & G. Clayson, Harrold	2,095	0	0
C. Clayson, Harrold	2,057	0	0
Ireton, Northampton	1,996	0	0
Brown, Wellingborough (accepted)	1,733	0	0

For a villa residence on the Bower Estate, Goldington-road, Bedford (exclusive of electric bells, grates, and chimney-pieces), for Mr. E. W. Perry. Mr. John Day, architect, Bedford:—

Kimberley, Banbury	£1,360	0	0
White, Bedford	1,324	0	0
Foster, Kempston	1,225	0	0
Adams, Bedford	1,215	0	0
Warton & Walker, Bedford	1,210	0	0
Smith, Bedford	1,[illegible]99	0	0

For additions to the Horse Shoe and Magpie Inn, Great Bath-street, Clerkenwell. Mr. W. Ansell, surveyor:—

Godden & Son	£168	0	0
W. J. Haskell (accepted)	148	10	0

Accepted for repairs to the Laurels, Tilehurst, Reading, for Mr. H. Hamp. Mr. George Waymouth, architect:—

S. Hunt	£471	0	0
Stables.			
S. Hunt and St. Pancras Iron Works	457	0	0

Accepted for the erection of four cottages at Hampton (Heathfield Estate), for Mr. Foy, Twickenham. Mr. Brown, architect, Richmond:—

A. Chivers	£400	0	0

For building four shops and dwelling-houses, with alterations, additions, new stables, &c., to the White Horse Public-house, Chislehurst, for Messrs. Marsden, Eastwalls Brewery, Chichester. Mr. T. S. Archer, architect:—

Coombs	£2,836	0	0
Holliday & Greenwood	2,397	0	0
Wood	2,394	0	0
Otway (withdrawn)	2,272	0	0
Lowe (withdrawn)	2,199	0	0
Second List.			
Picton	2,675	3	6
Arnaud	2,652	0	0
Wood	2,401	0	0
Holliday & Greenwood	2,367	0	0

For the erection of a wrought-iron highway bridge on cast-iron screw piles, over the river Nar, Wisbech-road (width of river 113 ft.). Mr. E. G. Mawbey, engineer:—

George Moss, 54, South Hill-road, Liverpool	£4,171	7	2
Thomas Gibson, 93, Stockwell Park-road, London	3,900	0	0
M. T. Shaw & Co., 141, Cannon-street, London Bridge	3,766	15	0
Handyside & Co., Britannia Iron-works, Derby	3,717	10	0
C. Williams & Co., 23, Queen Ann's-gate, Westminster	3,638	0	0
E. C. & J. Keay, Corporation-street, Birmingham	3,421	16	4
Bridge & Roofing Co., Darlaston, South Stafford	3,362	0	0
Green & Burleigh, Suffolk-lane, London	3 294	0	0
Goddard & Massey,* Nottingham	2,875	0	0

[Engineer's estimate, 2,900*l.*]

* Accepted.

For preliminary alterations to factory (No. 2), at Vauxhall, for Messrs. Barrett & Co., Limited. Mr. Edward Rawlings, No. 3, Victoria-street, Westminster, architect. Quantities by Mr. Morris Evans, 7, John-street, Adelphi:—

C. Dickinson, Loughborough Junction	£720	0	0
G. Stephenson, Hampstead	576	0	0
Fish, Prestige, & Co., Pimlico	574	0	0
H. & E. Lea, Warwick-street, W.	570	0	0
F. Higgs,* Loughborough Junction	510	0	0

* Accepted.

For the erection of a small block of artisans' dwellings in Half Nicholl-street, Bethnal Green, for Messrs. M. & A. Davis. Mr. C. A. Legg, architect, Mile End. Quantities by Mr. W. Hawker:—

Calnan & Co.	£1,491	0	0
F. & F. J. Wood	1,483	0	0
Mark Gentry	1,410	0	0
S. Jerrard	1,393	0	0
J. Holding	1,360	8	5
Paine Bros.	1,360	0	0
T. Higgs	1,280	0	0
J. Walker	1,279	0	0
W. & F. Croaker	1,278	0	0
Saunders & Co.	1,233	0	0
England & Thompson (withdrawn)	1,011	0	0

For new residence for Mr. Demery, at Bedford, Messrs. Usher & Anthony, architects:—

S. Foster, Bedford	£531	0	0
Freshwater & Corby, Bedford	527	0	0
George Haynes, Bedford	517	0	0
Wurton & Walker, Bedford	510	0	0
J. P. White, Bedford	505	0	0
G. Harrison, Bedford	497	0	0

Accepted for heating Queen's Head-street Schools, for the London School Board :—
Gardner's (J. & C. Christie), London £257 0 0

For the erection of new residence, Park-street, West Luton, for Dr. Kitt Tomson. Mr. W. J. Pearson, architect. Quantities not supplied :—

F. F. White	£1,080	0	0
D. Dunham & Son	943	0	0
R. Ford	795	0	0
Slough Bros. (accepted)	770	0	0

For the erection of three cottages in Crowhurst-road, Colchester. Mr. J. F. Goodey, architect :—

J. B. Payne	£520	0	0
A. Gladwell	505	0	0
A. Chambers	480	0	0
F. Dupont	474	0	0
G. Bowles	467	0	0
C. Oldridge	447	10	0
G. Dobson	439	0	0
E. Eade	419	0	0
H. Ambrose	398	16	0
A. Diss	380	0	0

For pipe-laying, supplying hydrants, cocks, sluice valves, &c., for the Local Board of Claines, near Worcester :—

Chandler & Sons, London	£2,100	0	0 !
W. Thomas, Bangor	1,298	0	0
Thomas Proud, Birmingham	1,228	0	0
Thomas Williams, Swansea	993	0	0
J. Guild, Newport, Mon.	970	0	0
H. Hill, High Wycombe	960	0	0
J. Bennett, Dudley	947	0	0
Jones & Fitzmaurice, Birmingham	937	0	0
F. C. Bugbird, Enfield	913	0	0
W. Bailey, Barrow-in-Furness	895	0	0
Evans Bros., Wolverhampton	888	0	0
J. Young, Skegness	855	0	0
G. Law, Kidderminster (accepted)	827	0	0
John Jevens, Dudley (withdrawn)	773	0	0 !

For rebuilding the Steamship, Naval-row, Blackwall, for Messrs. Truman, Hanbury, Buxton, & Co. Mr. Edward Brown, architect, Hanbury-street, Spitalfields :—

J. Anley	£2,445	0	0
C. Marr	2,390	0	0
W. Shurmur	2,340	0	0
S. W. Hawkings	2,215	0	0
Jackson & Todd (accepted)	2,175	0	0

For pewterers' work at the Ranelagh Arms, Roman-road, Old Ford, for Mr. N. Argent. Mr. Edward Brown, architect, Hanbury-street, Spitalfields :—

J. C. Edwards	£193	9	0
W. Rogers (accepted)	160	12	0
J. Thompson	159	10	0

For repairs, painting, and decorations at Clyde House, Tottenham, for Mr. Booker. Mr. A. Richards, surveyor :—

Smith	£155	0	0
Fairhead & Son, Enfield	153	0	0

For the erection of a villa residence at Surbiton Hill, for Mr. R. A. Morris. Messrs. Wilson & James, architects, Lonsdale Chambers, 27, Chancery-lane, W.C. Quantities by Messrs. Evans & Deacon, 1, Adelaide-street, Charing-cross, W.C. :—

J. & C. Bowyer	£1,825	0	0
W. Killick	1,750	0	0
T. R. Docking	1,727	13	6
Hill Bros.	1,720	0	0
G. Jervis Smith	1,628	14	6
R. W. Starkey	1,583	1	3
Turtle & Appleton	1,544	0	0

For new Vicarage House at Hessle, near Hull. Messrs. Botterill, Son, & Bilson, architects. Quantities supplied :—

F. Blackburn	£2,240	0	0
Simpson & Son	2,115	7	0
H. Grassby	2,106	0	0
M. Harper	2,051	0	0
E. Frost	1,960	17	6
R. Sargeant	1,900	0	0
J. T. Skinner (accepted)	1,839	17	0
D. Robinson (withdrawn)	1,827	0	0

For the erection of a new ward at the Merthyr Infirmary for the Poor, for the Board of Guardians :—

John Williams, Morgantown	£455	15	0
John Williams, Castle-street	390	8	6
W. I. Lewis (accepted conditionally)	310	0	0

For alterations at the Ivy House and rebuilding a shop and repairing two cottages, St. John's-road, Hoxton, for Messrs. B. & G. Hyams. Mr. Edward Brown, architect, Hanbury-street, Spitalfields :—

J. Kiddle & Sons	£2,325	0	0
S. Salt	2,175	0	0
J. Anley	1,960	0	0
C. Marr	1,945	0	0
W. Shurmur	1,944	0	0
S. W. Hawkings	1,897	0	0
Jackson & Todd (accepted)	1,822	0	0

For Barking sewerage works. Contract No. 2. Messrs. B. S. Bundell, Doncaster, and Mr. C. J. Dawson, Barking, joint engineers :—

G. Smith, Newcastle	£9,571	0	0
Hill & Co., Cathays, Cardiff	9,539	0	0
H. Hill, High Wycombe	7,908	0	0
J. Whetham, Weymouth, Dorset	7,273	0	0
Bottoms Bros., Battersea	6,914	2	4
G. Bell, Tottenham	6,495	0	0
Beadle Bros., Erith	6,128	0	0
J. Smith, Barking	6,038	0	0
Cook & Co., Battersea	5,853	0	0
Cunliff, Leigh, Lancashire (accepted)	5,302	0	0

Working Lads' Institute, Whitechapel.—We are asked by Mr. A. Reed, of Stratford, to say that his tender for this job should not have been included with the tenders for above given in our last issue (p. 255), as it was withdrawn on January 23.

SPECIAL NOTICE.—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our Office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

TO CORRESPONDENTS.

K. and Co.—W. E. M.—A. K.—E. L. B.—G. C. (we cannot answer such questions).—H. H.—G. A. W. (we cannot print your letter, which is practically an advertisement; but it has been forwarded to our correspondent).—A. H.—G. F. B.—F. W. (thanks; not required).—G. N.—W. G. S.—E. B.

All statements of facts lists of tenders, &c., must be accompanied by the name and address of the sender, not necessarily for publication.

We are compelled to decline pointing out books and giving addresses.

NOTE.—The responsibility of signed articles, and papers read a public meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news-items) which have been duplicated for other journals, are NOT DESIRED.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; all communications relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

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Advertisements for the current week's issue must reach the Office before THREE o'clock p.m. on THURSDAY.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to Advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

SPECIAL.—ALTERATIONS in STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same, must reach the Office before TEN o'clock on WEDNESDAY mornings.

PERSONS Advertising in "The Builder," may have *Replies addressed to the Office*, 46, Catherine-street, Covent-garden, W.C. *free of charge*. Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage.

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"THE BUILDER" is supplied DIRECT from the Office to residents in any part of the United Kingdom at the rate of 19s. per annum, PREPAID. To countries within the Postal Union, 26s. per annum. Remittances payable to DOUGLAS FOURDRINIER, Publisher, No. 46, Catherine-street, W.C.

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Box Ground, Combe Down,
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RANDELL, SAUNDERS, & CO., Limited,
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Dry Corsham Stone.
150,000 FEET CUBE.
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BOX, WILTS.
[ADVT

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Asphalte.—The Seyssel and Metallic Lava Asphalte Company (Mr. H. Glenn), Office, 38, Poultry, E.C.—The best and cheapest materials for damp courses, railway arches, warehouse floors, flat roofs, stables, cow-sheds, and milk-rooms, granaries, tun-rooms, and terraces. [ADVT.

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JAPANESE

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Hydraulic and Sanitary Engineers and Manufacturers.

Fig. ½.—J. TYLOR & SONS'
"SECOND QUALITY" VALVE CLOSET
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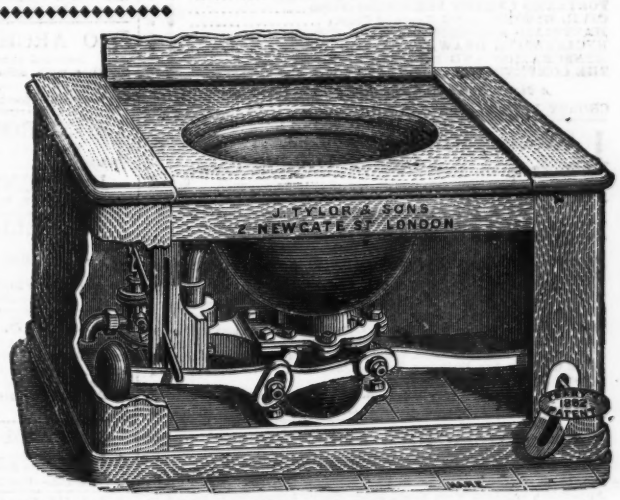

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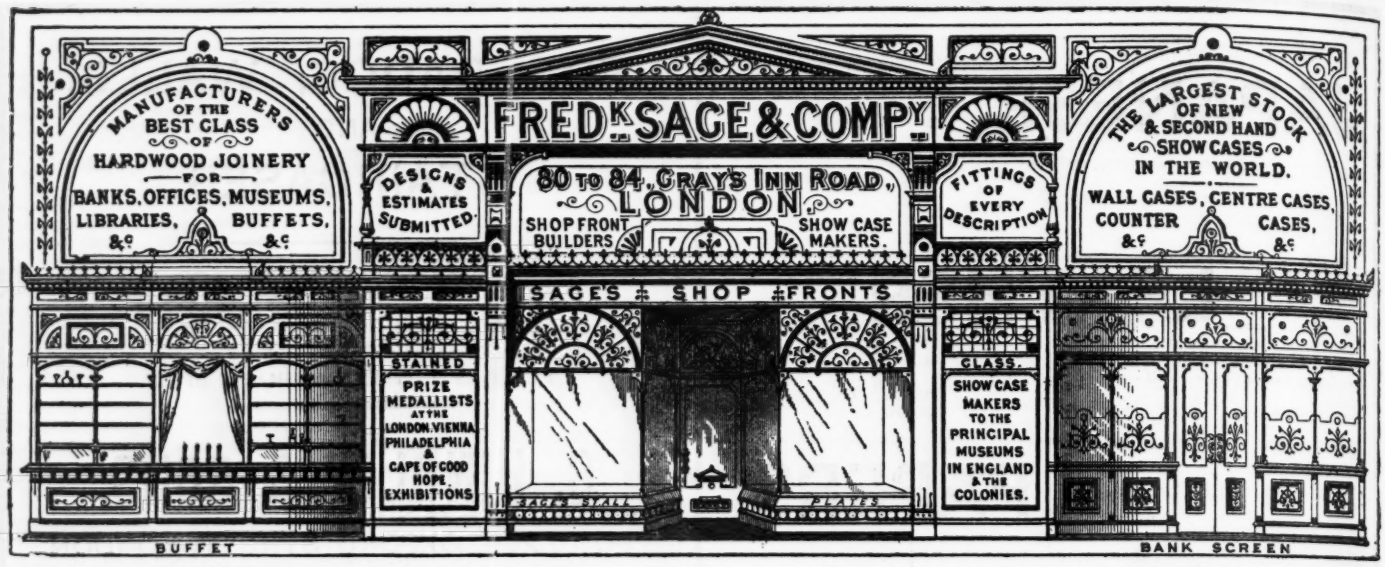
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